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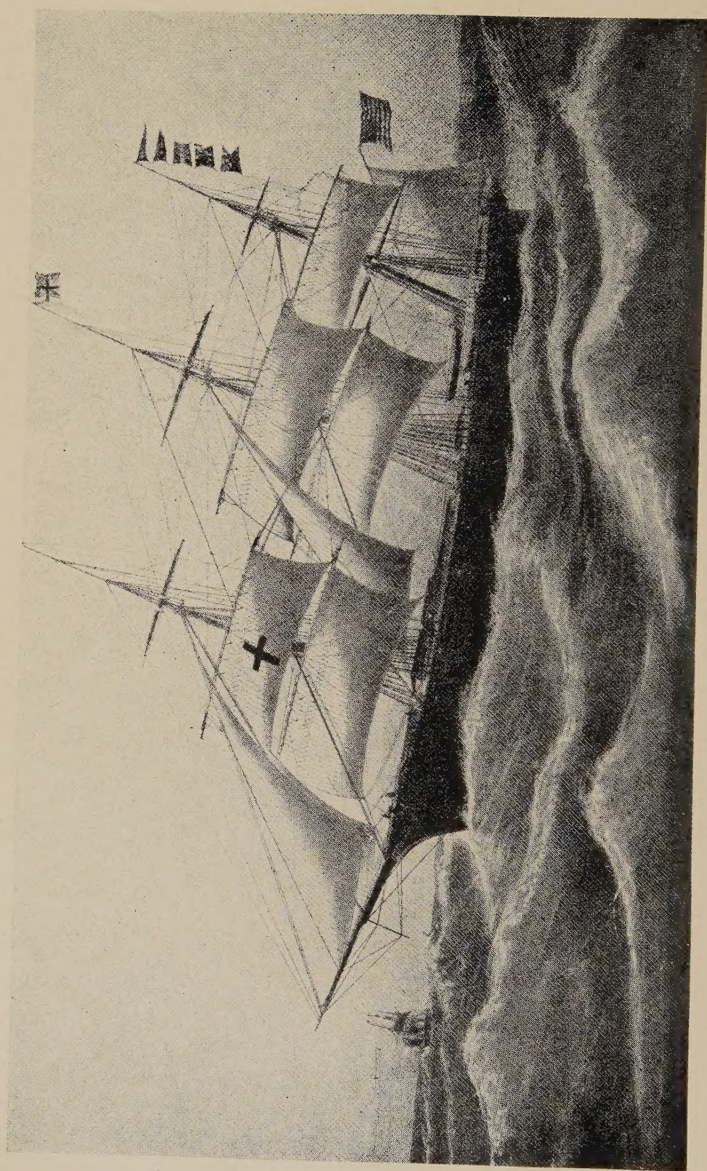
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American ship Dreadnought, 1850: she made the passage New York to Liverpool in thirteen days.

THE STORY OF THE SEAMAN

BEING AN ACCOUNT OF THE WAYS AND
APPLIANCES OF SEAFARERS AND OF SHIPS
FROM THE EARLIEST TIME UNTIL NOW

BY
JOHN FORSYTH MEIGS

LATE UNITED STATES NAVY

IN TWO VOLUMES

VOL. II.

ILLUSTRATED



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STORY OF THE SEAMAN

CHAPTER VIII.

Long-Ships from the Beginning of the Christian Era to End of Crusades.

Long-ships were used for war and to carry passengers and light freight. When occupied in the latter ways they were manned by fewer rowers and when so manned their manner of proceeding was the one they always followed: the voyage was broken into parts and dashes were made in fine weather from port to port between the ends of the voyage, for though their supply of food and water would last longer than when they had full crews, often tugging for hours at the oars, yet it was not to be trusted for long or uncertain time.

Trieres 3-oars of the Peloponnesian War were rowed by 200 oarsmen when manned for war and to understand how these may have been placed in 3 lines one above the other it is necessary only to determine the horizontal and vertical space required by a man to pull an oar; how far apart men must be horizontally in each line and how far apart the lines must be in vertical direction. Because the men were not exactly one above the other but forward and aft of one another as well as above and below the 3 horizontal lines were nearer than if the men had been exactly one above the other. These distances are, (1) the tholes in each line must be 33 to 36 inches apart; (2) the lines must be 22 to 28 inches apart.

THE HULL OF A VESSEL HAVING OARS IN SEVERAL LEVELS: NOT A
ZENZILE SHIP.

These 2 dimensions fix the design of row-vessels; but there are other limitations; (1) an oar beyond a certain length and weight cannot be handled no matter how many men are on it and no matter whether they stand in 2 lines before and behind the oar or are seated; which length has been put at 55 to 59 feet; (2) oars must have a certain proportion between outboard and inboard parts and between their length and the height from the water of their thole; which proportion is for the first about 2 to 1 and the second from 4 or 8 to 1. Upon considering all evidence it is impossible to believe otherwise than that oars have been used simultaneously at several levels in more than one part of the earth

and it aids our conception to note that there is no evidence they have been used in more than 3 levels: even the great Egyptian ship rated a 40-oar can be reconstructed with oars in 3 levels.³ In fighting trieres the oarsmen were above the main-deck and below the *catastroma* or upper deck. It results since there were 200 men in 3 horizontal lines that the rowing-chamber was about 14 feet wide 6 feet high and 90 feet long. Herein the men rowed seated not rising during the stroke as they would have done had there been room over-head. Beneath the main-deck and rowing-space was the hold of the width of the vessel and rowing-space and about 5 feet in extreme vertical dimension. Its floor was the ship's bottom, flat to make the ship take the ground conveniently, and top the main-deck. Into the hold on each side out near the ship's side entered the lower part of the body and legs of the rowers of the lowest tier; the *thalamitai*. Taking out the space thus occupied and that for ballast leaves a width of 7 feet amid-ships; for food water and stores. Thus as the triere was about 120 feet long the capacity of her hold was $120 \times 7 \times 5$; 4200 cubic feet. To consider now a few things she would keep here: small tents to shelter her men onshore would fill $\frac{1}{2}$ the hold; a canvas to tent over the whole ship if she carried this instead of small tents would occupy almost as much; a coiled hawser of fair length would occupy $\frac{1}{7}$ the hold; 2 pints of water per man per day for 10 days would occupy $\frac{1}{100}$ of it; without allowing much for wastage and packings her men would eat a holdful of food in 15 or 20 days. War-stores, bows arrows javelins swords and spears stones to throw, must have been kept in the hold; for some it was necessary to keep dry and all stored in orderly way and accessible. Even stones to throw called for forethought; a commander going a cruise would hardly be satisfied with a supply for less than an hour; if he had 10 men who threw and each threw 20 stones per minute an hour's supply of 3 inch round stones would fill $\frac{1}{25}$ the hold.⁴ There would be 1200 stones weighing about 3000 pounds.

³ Above p 80. See Mar de Guerre Serre v 1 pp 5-20 as to dimensions given; particularly p 19 where are stated views that more than 3 lines of oars have never been used.

⁴ A viking once made everybody 9 years of age or more in a captured town bring to his ships 5 stones good for throwing; Laing Heimskringla p 203 v 3. Stones were terrible weapons; see p 287 v 1 same work; a routed fleet is driven to the beach and the men leap from the vessels and fly; a saga tells of this,

"Many a warrior's shield I ween
Might on the warrior's back be seen
To shield him as he fled amain
From the fierce stone-storm's pelting rain."

They are still employed in some places and were used in a battle off Flanders in 1710; see Mem d'un Protestant cited below p 514, p 525.

They would be distributed along the ship's length and going out at the rate of 200 pounds per minute when in battle. We do not read of ships dropping over on their sides because of change of weights but their design was a close problem. If stones were slung they would go out slower range further and a blow from them would be more serious; but slings were not often used in ships because they are whirled about the head for which row-ships could not spare room.

SAILS OF LONG-SHIPS.

Long-ships used sails when possible. They had considerable weights high rowers and fighting-men and must have carried ballast when expecting to use sail. The scale drawing of a triere at the end of v 1 Serre's *Marines de Guerre* represents a vessel one might expect to drop on her side if her oars were laid in as a modern racing-shell will do. In war time long-ships did not usually carry their larger sails and mast and landed them before battle; retaining the smaller sail and mast.⁵ Tents or material for huts to live in ashore were usually aboard ships even when fighting was imminent and must have impeded rowing unless stowed below; masts and sails would be still more in the way. On passenger and mail service Greek long-ships carried with them 3 masts; one stepping in the vessel's center and with at least 2 square sails; the other 2 masts had fore-and-aft sails, one having 2, one above the other.⁶ With masts and sails and part crew of oarsmen, perhaps $\frac{1}{2}$ or $\frac{1}{3}$ of complement, runs could be made from point to point by watching the weather. With few oars a ship was in part independent of the wind and oars would be necessary in case the ship were blown away in spite of promised good weather.

LONG-SHIPS IN BATTLE.

In Europe long-ships held a place in the line-of-battle until nearly 1700; and though never held in esteem in the Ocean are found there occasionally. In years 1650 to 1700 they are seldom in fleets even in enclosed seas and in 1748 the Royal Galley Corps of France was formally abolished.⁷ Row-ships were replaced in war by sailing-ships carrying

⁵ Xenophon *Dakyns* trans 4 vs v 1 p 40, bk 2; v 2 p 148, bk 6. Above p 165 is given a case of long-ships sailing into battle.

⁶ Such is the record of lists of stores found at Athens in 1834: see Cartault *Tr Athen* pp 202, 178-185; Serre *Mar de Guerre* v 2 p 298: Cartault's words are given p 92 above.

⁷ See p 73 above and picture here inserted.

many guns in broadside and passed away when guns became capable of stopping their charge to ram. As row-ships steered for the side of becalmed sailing-ships, for they could never do anything at all when there was a breeze, they fired their bow-guns, almost the only guns they had, rammed and boarded. But this as guns in ships became numerous and ways of handling them better was very dangerous: the slaughter among the closely packed oarsmen caused by a well-directed shot must have been terrible.⁸ The last great sea-battle in which row-ships played the principal part was Lepanto 1571 fought in the Mediterranean between Christian and Turkish fleets; in the fleets which fought in the Ocean in 1588 on the coming of the Invincible Armada they were present but played unimportant part.

LONG-SHIPS AS PACKETS.

As packets for mails or passengers long-ships disappeared when sailing-ships were safe and punctual and because slaves became fewer as time went on and free and paid oarsmen rendered rates of passage by row-vessels more and more high. We can understand that voyages in long-ships had many advantages for all slept and ate in comfortable places onshore and ships remained in harbor until the weather was good.⁹ Von Suchem who went to the Holy Land in 1350 wrote,¹ "A long-ship journeys from one shore to another from one port to another keeping ever close to the beach and always putting into harbor ashore for the night." Another author, writing in 1402, mentions the length of a certain voyage in a round-ship and adds, "Long-ships, that hug the shore, take longer."² Nearly 100 years later in the days when Dias found the Cape of Good Hope by a long run in a round-ship, a voyager in a ship with 330 souls aboard of whom 110 were passengers wrote, "On this deck dwell the galley-slaves each man upon his own bench, and there they sleep eat and work."³

Long-ships were widely used until 1500 to 1600 A D and during the

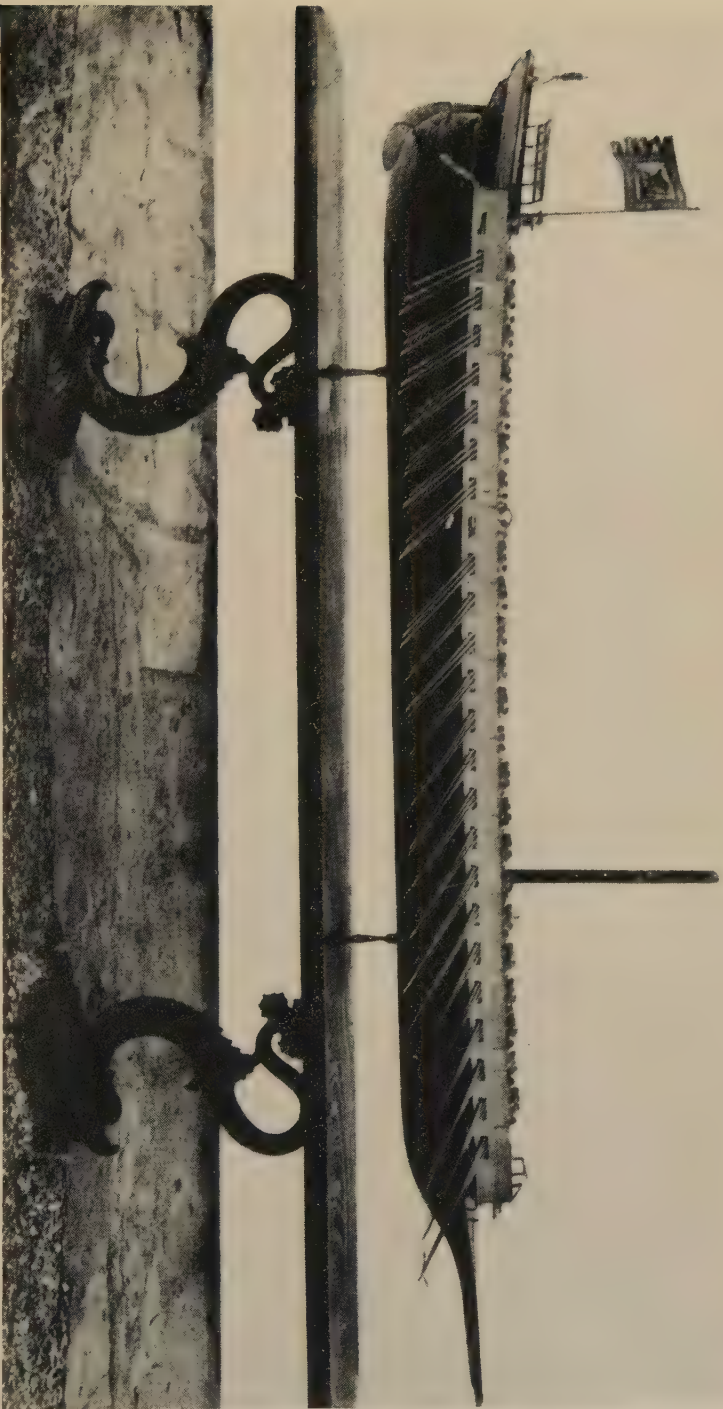
⁸ Mechanical guns could be mounted on the broadside very close together and numerous and were formidable to men slightly covered: the bolt from man-carried cross-bow would perforate a steel breast-plate. That the heavier standing cross-bows may have been used in this way is indicated but not recorded.

⁹ Above p 213 as to experiences of travellers in these ships.

¹ Above pp 287 and foll'g.

² The passage and authority are given p 287 above.

³ Above pp 292 and foll'g for fuller extract. In round-ships also men lived on the upper deck: see note A at end of this chapter, p 434.



From Fincati's Tirenni identified in picture at p 78. She is a zenzile tireme, having three oars and three oarsmen at each of twenty-three ports on each side—one port not in use—sixty-nine oars on a side. Not only are the three oars in ports showing but three oarsmen as well; oarsmen are protected, but probably the bullmark was never so high the blades of oars when in the water could not be seen. Guns are shown in the bow, indicating the date of the vessel is not earlier than 1450–1500; by that time scaloccio rowing had displaced zenzile. This is seemingly a model constructed by Fincati.

period of 3000 years in which we have account of them changed little in fundamentals; their masting the cut number and size of their sails their manner of rowing, altered from time to time and differed slightly in different countries, but they remained always of low sea-keeping quality, low sea-endurance. They carried so many men were so sharp crank and on top of the water, that life aboard was unendurable and they carried little water and food. In habitability they resembled in some degree the modern destroyer. Round-ships were replaced by sailing-ships, like round-ships of old as to principal qualities, and these after short time by steam-ships.

PILGRIMAGES TO SACRED PLACES.

Pilgrimages have been numerous in all ages and places and though primarily for religious ends the purposes of trade have been joined to those of devotion in ways and in a degree which would not obtain in modern days. We have some record of Christian pilgrimages to the Holy Land and other sacred places which when St Helena the mother of Constantine, who established himself as Emperor at Constantinople in 330 A D, went to Jerusalem increased in number greatly.⁴ In matters of detail the records are meagre but as all went in part at least by sea, for the way was long and difficult and beset by hostile non-Christian peoples, some information may be gleaned. In the accounts nothing is stated as to difficulty in finding ships bound east, usually from Barcelona Marseilles or an Italian port, and these we may assume had been going eastward a long time before pilgrims went to Jerusalem.

Christians continued to go for centuries in comparative peace but about 650 the followers of Mahomet upon conquering Syria and Palestine often treated pilgrims with violence and rigor, in consequence of which in the lapse of time came the Crusaders Holy Wars whose purpose was to drive the Infidel from the Sacred Places. Thus from 300 and earlier to 700 ships carried pilgrims east in peace and after 700 the pilgrims continued to go but were harried on sea and land by the Moslems. During these years ships of cities of the Mediterranean, as well as some on the Atlantic, frequented the harbors of Syria and the Nile-mouth carrying thither pilgrims and supporting them there and trading with the Infidel as well, often in defiance of the mandates of the Church. During these days as in those

⁴ Above pp 219, 283.

of the formation of the Roman Empire the ships were playing a great part; round-ships carrying men and supplies and earning money to support the effort of those at home, and long-ships holding the sea open for the round-ships; no easy task this for after about 700 and until the Crusades the Mahometans were not only in Syria and Egypt but in the islands in the Mediterranean whence issued their corsairs to plunder and burn Christian ships; carrying away those worth ransom and drowning others.⁵

BATTLES; FROM ACTIUM 31 B C UNTIL THE CRUSADES.

At the time of Actium Roman ships and those of her tributaries filled the Mediterranean and since Rome held Britain until about 425 A D her ships were also in the Atlantic while her subject peoples and others dwelling on the Atlantic never ceased trafficking along its shores and west to the off-shore islands and south on the coast of Africa. Roman ships were also in India and east of it in the day of Actium as Strabo who lived in that day has written.⁶ To show that ships were numerous between Actium and the Crusades, an interval of more than 1100 years, the principal war operations on the sea may be noted. At Actium where Augustus won his crown there were present in the 2 fleets about 500 fighting ships with 110000 men aboard them;⁷ the Roman ships and men coming from the western Mediterranean and those of Antony from its eastern end. Then followed the so-called Peace of Rome during which no great fleets met for 350 years, not until Constantine established himself at Constantinople by the victory of his fleet over that of Licinius in the Hellespont in 323. Constantine had 200 war-ships and a great number of round-ships, there being onboard his vessels 26000 infantry and 10000 cavalry; Licinius mustered 350 war-ships, a few more than Constantine. The fleets were hardly smaller than at Actium though the date is the threshold of the Dark Ages while Rome was in her glory in the day of

⁵ There are pictures of ships of the West preceding the Crusades; long-ships are shown in the Bayeux Tapestry Fowke London 1875; in Palazzo Ducale di Venezia Zanolto 4 vs pls 133, 140, 143, v 3; in Arch Nav Jal v 1 Batiments à Rames. For round-ships see seals pictured pp 399-403 v 2 Lindsay Hist Merch Ship; v 2 Jal Vaisseaux Ronds. See Piranesi Antichita Romane v 13 for pictures and sculptures of ships in the Vatican.

⁶ Above p 328.

⁷ Above p 189, statement of Orosius: he says there were 18 legions in the 2 fleets; a legion mustered about 6000.

Augustus. The fleet of Licinius like that of Antony came from the eastern end of the Mediterranean that of Constantine from the west.⁸

THE ROMAN AUTHOR VEGETIUS.

Shortly after Constantine lived Vegetius who wrote of military affairs on sea and land.⁹ In his 5th Book he writes,¹ "It remains to give some account of the marine and this will be comprised in a small compass our operations against the barbarous nations having for a long time past been confined solely to the land. The Romans in the first ages of the Republic only fitted out their fleets in cases of necessity where their honor or interest were concerned but after a time it was found necessary to keep fleets always in readiness xx. One was therefore stationed at Misenum and another at Ravenna and each had a legion appointed for its service xx.² Each long-ship has a captain whose particular duty it is besides other things to exercise the pilots rowers and soldiers. xx At Actium where Augustus defeated Antony chiefly by means of the auxiliary ships of the Liburnians, their superior excellence appearing conspicuously they were preferred to every other sort. From this period the Roman emperors built their ships after this model and adopted the name *liburnæ*. xx Liburnæ are generally built of cypress xx; brass nails are much better than iron ones xx for iron nails exposed to air and water are soon destroyed by rust. xx The proper time for felling wood for sea-service is from the autumnal equinox till the 1st of January for in these months the sap has done rising. Timber must never be cut into planks when first felled nor the planks used in construction of vessels immediately when cut. xx The smallest liburnæ have a single rank of oars those of the middle size 2 and those of large dimensions 3 4 and sometimes 5. Nor will this

⁸ Hist Zosimus London 1814 pp 46-9; also Hist Romane Zosime trad Cousin. Zosimus was co-temporary of Orosius, about 400. They may both have known men who were in the battle. Gibbon describes this battle in chap 14.

⁹ Instit Flavius Renatus Vegetius trans Clarke London 1767: the date of the book is fixed by its dedication to the Roman Emperor of 375-392. There is an ed in French of 1536: this includes the military treatises of Frontin and Ælian both about 100 A D and many pictures of date of its publication, not Vegetius' date: at end bks 3 and 4 are shown (the date would be 1536) devices for submarine work and a catapult for projecting stones or arrows in horizontal fire; at end bk 1 is shown a man holding by both hands a bar to which a sling is fast whereby he uses both arms to sling. There is also an Eng ed of Ælian, wherein p 29 it is stated slung stones were accurate and formidable up to 200 yards. See just below, p 365 for remarks of Vegetius about the fire of stones and n 5 p 365 for his remarks about use of *fustibalus*.

¹ Pp 195-207.

² About 6000 men.

seem prodigious when we are told they had much larger ships at Actium, of 6 ranks of oars and even more.³ Small vessels of about 20 rowers on each side are also appointed to attend on the large liburnæ. These are employed in surprising enemy's ships intercepting their provision-transports reconnoitring their motions and discovering their designs. But as their whiteness would show at a distance their sails and ropes are tinged sea-green to resemble the color of water and the composition the sides are payed with is colored in the same way and the seamen and soldiers are clothed in the same colors. Whoever commands an army at sea should be thoroughly acquainted with the prognostics of bad weather for more ships are lost by storms than by engagements with the enemy. This requires great skill in natural philosophy which teaches the nature of winds and tempests by the knowledge of the heavens xx. In some seasons of the year the stormy weather makes it impossible to keep the sea xx. The skill of pilots consists in their perfect knowledge of seas and harbors xx; the deeper the sea the greater the safety. The principal qualification in the captain is vigilance in the pilot skill and in the rowers strength because naval engagements are fought when the sea is calm and the ships not moved by the wind depend entirely on the force of oars either to attack the enemy's ships with their beaks or in their turn to avoid the shock, and in these manœuvres it is the strength of the rowers and the dexterity of the pilot that generally decides the victory. Different kinds of arms are required in a battle by land but many more in an action by sea, and also machines and engines like those used in the attack and defence of places."

The last words mean that men in the day deemed war on the sea of the same general character as the attack and defence of fortified places and show that war-ships carried guns: the tactics of fleets differed it was held from that of field armies. If we conceive *places*, fortified castles or cities, to be in motion, their operations would be like those of heavy ships: and places on shore, positions, and ships use guns-of-position; those which unlike man-carried or wagon-carried guns are moved rarely and slowly. Vegetius says in effect that war-ships mounted guns-of-position, the kinds on walls and in embrasures of castles and cities; large projectile-throwing engines set on framework. The war-ship was in this like those of today.

To return to Vegetius where left off; "Combatants," he says, "Should

³ It is certain that 900 years after Vegetius' day men sat all in one level in Venetian galleys; *zenzile* rowing. His words are not irreconcilable with this; all depends here as elsewhere on what a word or two mean.

be completely armed with cuirasses coats of mail helmets and greaves, for soldiers who fight in ships without stirring from their posts cannot complain of the weight of their arms.⁴ Their shields should be of a larger and stronger make to resist the blows of stones and to protect from scythes hooks and other naval weapons. They engage with all kinds of missive weapons, with stones arrows darts and loaded javelins, thrown by slings and *fustibali* or shot from the *onagri balistæ* or *scorpions*.⁵ But the bloodiest part of an action is when the most intrepid after the ships are laid alongside and bridges thrown between board the enemy and engage sword in hand. Turrets are also erected in the largest ships to enable them to annoy the enemy and destroy them more easily as from the top of a rampart. Arrows covered with tow and a composition of incendiary oil sulphur and bitumen are also shot from the *balistæ* into the enemy's ships, and fixing in their sides which are payed with wax pitch and rosin instantly set them in a flame. Thus in engagements by sea some fall by the sword some are destroyed by stones and some perish by fire in the midst of the waves and all are denied the rite of sepulchre."⁶

Our author continues, "Endeavors are used to surprise an enemy off his guard at sea as well as on land and ambuscades formed for that purpose in the most convenient straits and passages of islands. If their seamen are fatigued with rowing if the wind or tide is against them if they suspect no danger xx we must by no means neglect the favors of fortune but engage on such advantageous terms. If they avoid your snares and force you to a general action the ships must form the line-of-battle, not in a direct line as an army is drawn up at land but in the form of a half-moon. Thus the wings will be advanced and the center hollow and if the enemy attempt to force the center they will find themselves wholly surrounded. The ships of the greatest force and best troops are for this reason to be posted in the wings. It is very essential to secure sea-

⁴ Soldiers often rowed when this would not apply.

⁵ These 3 were throwing-machines; being here of position or standing character. The *fustibali* were the 2-hand slings referred to above: of these Vegetius wrote p 132 Eng ed, "The *fustibalis* is a staff 4 feet long to the middle of which is fastened a leather sling; it is used with both hands and throws stones almost in the same manner as the onager. The common sling is made of hemp or of the hair or bristles of animals xx and casts the stone with a turn about the head." See picture p 114 above for man slinging stones, also throwing them, also 2 *balistas*.

⁶ The arrows carrying incendiary substances shot from *balistæ* and sticking in the ships should be noted for they show the *balistæ* were standing-machines, not man-carried cross-bows, which came later to be called *balistas*: it is thus shown standing-machines were in ships about 325 A D and no doubt for material time before and after.

room for your own fleet and straighten the enemy by driving them to the shore in which confined situation they cannot work their ships so as to engage with the proper impetuosity. In sea-engagements 3 sorts of weapons are very serviceable, iron-headed beams scythes and double pole-axes. These beams are long and slender, armed with iron at both ends and suspended on a mast like a yard. On which side soever the enemy attempts to board this machine worked in the same manner as a ram destroys their soldiers and seamen and frequently perforates the ship itself. The scythe, a sharp and crooked iron so-called from its resemblance to that instrument, is fixed on a long pole; with this is suddenly cut the ropes that suspend the yards and sails and thereby render the ship motionless and unserviceable. The double pole-axe is an axe with 2 very sharp and broad edges; with this weapon the most dexterous and resolute soldiers and sailors in the very heat of action privately cut the tackles that fasten the rudders of the enemy's ships whereby they are instantly disabled and taken. For what can a vessel do that has lost its rudder? I shall say nothing of the armed vessels kept day and night as guard-ships on the Danube; the great perfection to which they have attained is owing to the frequent use now made of them and not to any instructions left by the ancients."

In another place is a treatise on projectile-throwing engines; "Against these machines of the besiegers," Vegetius writes,⁷ "Are used the balistæ onagri scorpions arcubalistæ fustibali slings and arrows. Balistæ are bent with cords of sinews; the longer its arms, that is the larger the engine itself is, the farther it throws the darts; if constructed with proper proportions and served by skillful men acquainted with its powers it penetrates whatever it strikes. Onagers according to the strength and size of their cords throw stones of different weights, the largest impelling the most ponderous bodies with a velocity like that of lightning. These 2 engines are more formidable than all the others. The manubalista, because it kills with small and slender darts, was formerly called a scorpion. It is superfluous to describe the fustibalus arcubalista and slings as they are so commonly used and well-known at present. I shall observe with respect to the onager that the stones it throws are of such enormous weight as not only to crush men and horses but also to break in pieces the machines of the enemy."

⁷ Pp 185-6. Darts could be used only in horizontal fire; stones in either horizontal or vertical fire: that is the former were shot by cross-bows the latter by these or from slings at the ends of revolving beams.

The fustibalus is the 2-handed sling of which Vegetius' description is just above; the onager is what is often called a catapult, a beam swung in the vertical plane usually by a weight released carrying at its upper end a sling in which was placed a stone or similar projectile: this was used in vertical fire; it did not throw arrows or long projectiles. The balistæ scorpions arcubalistæ and manubalistæ were cross-bows for horizontal fire and projecting arrows or stones; the first 3 were probably standing, and last portable machines. A different throwing-machine is described in the French edition of Vegetius cited above: ⁸ an arrow is laid across a post fixed vertically in the ground or on a base; a strong and flexible bar is also fixed vertically in the ground or the base, the last being bent out of the vertical and caught by a trigger. When an arrow or stone is placed on the post the trigger holding the bent bar is moved and the bar flies into the vertical striking the arrow or stone. As stated above the picture belongs in the date when this edition was published, 1536, when gun-powder guns had been in use 200 years, though probably such machines were used much earlier.

There are other interesting passages in Vegetius; for example,⁹ "The maxim of Scipio that a golden bridge should be made for a flying enemy has been much commended:" a note adds that the ancient Jews when they invested a place left a part free so the enemy might escape. He writes also,¹ "The watches of the night are divided by the hour-glass that each might stand only 3 hours." Every legion of the Roman army had, he says,² "A travelling workshop wherein they made shields cuirasses helmets bows arrows javelins and offensive and defensive arms of all kinds xx. Each had a body of miners who by working underground and piercing the foundations of walls xx penetrate into the body of the place xx. Recruits are to be exercised with wooden swords at the post xx; they must be instructed how to spring forward to give the blow to rise with a bound above the shield and then to sink down and shelter themselves under cover of it; in what manner to advance and how retire. They must also throw their javelins at a post from a considerable distance to acquire good aim and to strengthen the arm. The archers and slingers set up bundles of twigs or straw for marks and generally strike these with arrows and

⁸ P 363 n 9; the desc is at end of bk 3: see the picture here inserted.

⁹ P 149.

¹ P 114.

² P 63. A legion comprised 6000.

with stones from the fustibalus at a distance of 200 yards. xx The slingers should be taught to xx whirl the sling but once around the head before they cast the stone; formerly all soldiers were trained to the practice of throwing stones of a pound weight with the hand, which is thought the readier method as not requiring a sling.”³ He writes also, “The stones found in rivers, as of the heaviest kind and most proper for the use of slingers, are to be carefully collected and piled up in heaps xx. The smallest are thrown by the sling by the fustibalus or by the hand, those of the middle size by the onagri, and the largest and roundest are disposed along the parapet to be rolled down on the enemy xx.”⁴ Armies in the field had good maps often making them themselves.⁵ “The war shout should not be begun till both armies have joined for it is a mark of ignorance or cowardice to give it at a distance, the effect is much greater on the enemy when they find themselves struck at the same instant with the horror of the noise and the points of the weapons.”⁶ He says, “A battle is commonly decided in 2 or 3 hours,” and,⁷ “The legion owes its success to its arms and machines as well as to the number and bravery of its soldiers. In the first place every century has a carro-balista mounted on a carriage drawn by mules and served by a mess that is 10 men from the century to which it belongs. The larger these engines are the greater distance they carry. They are used not only to defend the intrenchments of camps but are also placed in the field in the rear of the heavy-armed infantry, and such is the violence with which they throw the darts that neither the cuirasses of the horse nor shields of the foot can resist them. The number of these engines in a legion is 55. Besides these are 10 onagri; they are *drawn ready-armed* on carriages by oxen; in case of attack they defend the works of the camp by throwing stones as the balistæ do darts. The legion carries with it a number of small boats, each hollowed out of a single piece of timber with cables and sometimes iron chains to fasten them together. These boats joined and covered with planks serve as bridges over unfordable rivers on which both infantry and cavalry pass without danger.”

The word carro-balista is given in dictionaries as a balista mounted

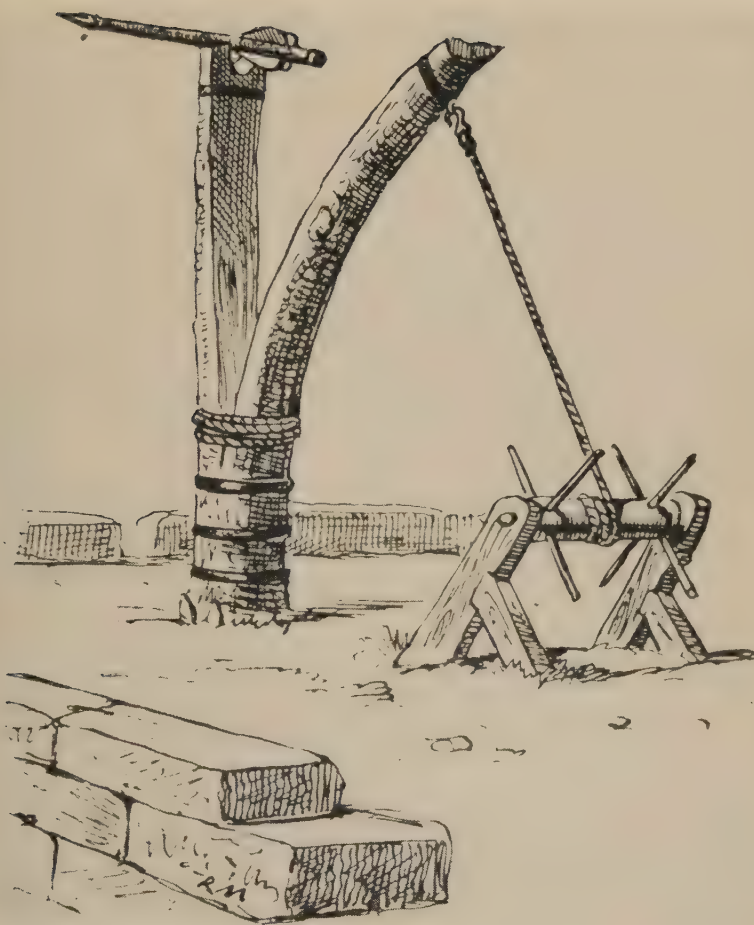
³ P 81. These stones would be about 3" in diameter.

⁴ P 174.

⁵ P 103.

⁶ P 139.

⁷ Pp 115, 83. See p 99 above for picture of a mechanical field gun more than 200 years before Vegetius' day.



This is lam 4 in Marino del Siglo XV en la Esposicion Historica, D Caesar Duro; the legend with the picture reads, "Ballistie machine that fired the arrow that struck the galley of Alfonso V of Aragon at the assault of Marseilles in 1423 deposited as a trophy in the Cathedral of Valencia, according to the description of the said catapult or machine made by the Chronicler Beuter."

on a carriage; and manu-balista as a hand-balista. Thus a Roman legion, 6000 men, had 55 field-guns to use the modern name and 10 heavier throwers called onagers. The last consisted, we may infer from the text, of a beam carrying a sling with a stone in it at one end and connected at the other end with a weight which could be tripped when the machine was to be discharged. The beam was *ready-armed*, hove down, during transportation. This is vertical fire, fire at high angles: carro-balistæ were large cross-bows on wheel-carriages and fired darts horizontally at low angle and high velocity.

FLEETS FITTED TO DRIVE THE VANDALS FROM AFRICA.

Having extracted the matters of interest in Vegetius of about 375 we take up again war operations to ascertain the number and capabilities of ships at the beginning of the Dark Ages. In about 440 and 468 great fleets were assembled by the Romans to conquer the Vandals who had entered northern Africa and islands in the western Mediterranean and in 455 sent an army over-sea to Rome and sacked the city. Procopius who was of the day wrote of the sack,⁸ "The Vandal King Genseric loaded his vessels with a prodigious quantity of gold silver and the most precious articles in the Empire xx. He pillaged the Temple of Jupiter Capitoline taking half its roof which was of gilded copper and of marvellous beauty. It is said the vessel loaded with the Gods perished while all the others returned to Carthage." Procopius continues,⁹ "Leo wished to avenge the Empire for the outrages of the Vandals and raised an army of 100000 men and assembled a fleet of all the vessels in the East. He gave magnificent presents to the sailors and soldiers sparing nothing in the design he had at heart. But as God did not wish that these superb preparations should exterminate the barbarians he allowed Basilicus brother of Verina to be chosen general." Our author narrates how the armada when near Carthage was destroyed by fire-ships.¹

Here may be noticed reflections of Procopius as to differences between ancient war and that of his day. They are about land war but written

⁸ Hist Guerre Vandal in Hist Constantinople Cousin 8 vs v 1 p 210. Procopius was secretary to Belisarius and with him when he took Carthage the capital of the Vandals in 533.

⁹ P 212 v cited; two Leos succeeded each other 457-74.

¹ See also Finlay Hist Greece v 1 p 168 where it is said this exp comprised 100000 men and 1113 vessels; less than 90 men per ship but no doubt there was munition of war in the ships.

by a soldier of experience and are the earliest remarks of their character; "Some call our soldiers bow-men in derision," he says,² "Reserving for the ancients the name of buckler-men and fighters with *firm foot*. They do not believe this ancient virtue has come down to us xx. The bow-men of Homer had neither horses javelins nor bucklers, they made war only on foot and covered themselves with a buckler carried by a companion or hid behind an eminence xx. They made no war in the open field. xx They shot badly with bows and without force making only slight wounds. Our bow-men go to the combat with cuirass and thigh-piece and carry their arrows on the right side and a sword on the left. Some carry a javelin on the shoulder and a buckler with no handle with which to cover the head. They are such good horsemen that they shoot to all sides when at a gallop and do not miss whether pursuing or flying. Raising their bows as high as the face they draw the cord until it touches the right ear and shoot the arrows with such violence that they will pierce everything, neither bucklers nor cuirasses can resist them. Yet many have an admiration and respect only for past ages, and hold lightly all the moderns have done to improve the arts." Neither Vegetius nor Procopius writing in the interval 350 to 600 say anything of the substances now called explosives. Materials which burned were used, but no-one thought of making something which would burn so rapidly as to *project itself* or another object. Soon after the day of Procopius we come to this.³

BELISARIUS LEADS AN EXPEDITION TO AFRICA AGAINST THE VANDALS: 534.

The next great armada in the Dark Ages was commanded by Belisarius; it sailed from Constantinople in 534 and Procopius who went with his chief wrote a history of its operations. Probably neither Belisarius nor Procopius were seamen but like all who had been abroad they had been in ships. Of this expedition Procopius writes,⁴ "Justinian prepared an army against Africa to be composed of 5000 cavalry and 10000 infantry. xx There were 50 vessels of which the largest carried 50000 *minas* of corn and the smallest 3000. There were 20000 sailors

² Hist Guerre contre Perses v 1 p 2 in Cousin's Hist. The fighting *with firm foot* of the ancients is described p 171 above: see also below p 374 for men in ships fighting with *steady foot*.

³ Below pp 376 and foll'g.

⁴ P 230 v 1 Cousin's Hist. For comment see Mahon's Belisarius pp 76-139: there is a map in this on which the voyage may be traced. See Nordenskiöld Periplus p 4, for summary of the sea-faring side of the expedition. Justinian was Emperor 527-565.

drawn for the most part from Egypt Ionia and Cilicia.⁵ Calonymus of Alexandria was pilot.⁶ There were 92 long-ships armed for war with one row of oars and covered so that the rowers were not exposed to the enemy's missiles. These were called *dromons*⁷ because they are very fast. There were onboard them 2000 men of Constantinople who all knew how to row, there was not one useless man. Belisarius was commander-in-chief. xx The Emperor put all power in his hands; he was born in the territory between Thrace and Illyria. xx In the 7th year of his reign and at the season of the summer solstice⁸ Justinian ordered the admiral-vessel which was in the port to come before the Palace. Epiphanius Bishop of Constantinople entered and made the usual prayers xx. At the same time with Belisarius and his wife Antonina sailed Procopius the writer of this history."

To examine Procopius' figures: he appears to say 92 dromons were rowed by 2000 men, barely 22 men each; this is probably an error for to accommodate 11 rowers on a side the dromons would need to be only 35 to 40 feet long and that the ships carried horses and Belisarius with his wife were in one and the Bishop came onboard to hold religious service indicate large vessels. Further; on the page beyond the one where the words quoted are found are these regarding preparations made at the time by Gelimer King of the Vandals, "Having thus embarked 5000 Vandals in 26 vessels." This is nearly 200 per ship, the number of rowers Athenian trieres of 1000 years earlier had. A ship with 100 rowers on each side in one line would be 300 feet long; if her rowers were in 3 lines one above the other or sitting 6 on each entire thwart as in zenzile rowing her length would be $\frac{1}{3}$ this. It may also be that Belisarius' ships were manned by part-crews of rowers and carried munitions and soldiers.

⁵ Mahon's Belisarius p 80 says, "The fleet was manned by 20000 sailors from Egypt and Asia Minor and composed of 500 transports whose size might vary from 30 to 500 tons:" to this is added a note saying that in the tonnages given he follows the account in Gibbon's Rome and that Cousin who we are following errs in giving the number of vessels as 50, for the number in the original work is 500: a credible mistake when we recall the difficult system of notation of the day. The Roman mina was about a pound; the figures hold out well.

⁶ Procopius mentions the name of the pilot and commanders of horse and foot: seamen have never been held in dis-esteem. Calonymus must have had charts showing Constantinople Africa and intermediate points; probably soundings were marked.

⁷ Jal Gloss Naut also Arch Nav says these were, "Of the family of long-ships used in the first centuries of the Christian Era." Authors who wrote during the Crusades use the name.

⁸ About June 22, 534.

To resume Procopius' story, "The Admiral with all his fleet proceeded to Heraclea and remained there 5 days for the Emperor had promised a supply of Thracian horses. Thence they proceeded to Abydos where they were detained 4 days by calm.⁹ After this Belisarius took means to keep the fleet together for he knew powerful naval armaments are often scattered by violent winds and that the best pilots experience difficulty in conducting fleets during a storm. He therefore ordered the upper parts of the sails to be marked with red as well his own vessel as 2 others carrying principal officers and to attach to them aloft blazing lights so that they might guide the fleet by day and night. When he left a port the trumpet gave the signal. They sailed from Abydos and were carried by a strong wind to Sigea and then with a pleasant breeze to Malea xx."

If this means Cape Malea at south end of Greece this run was 350 miles. Hereafter the itinerary becomes partly impossible to understand; but the fleet reached presently the island Methone at the south-west corner of Greece and here the army was landed. It is impossible to tell how long they had been onboard ship for Procopius does not say how long the runs took. The fleet had come about 550 miles and it is indicated they were sailing 7 or 8 days; Procopius says they lay in port 9 days in all; so counting 2 or 3 days' delay after the men went onboard they must have been in the ships quite 20 days. It follows from Procopius that the army was in the transports, where there was room to move about a place to sleep drinking water and cooked food. The men in the long-ships did not have all these comforts but may have been onboard about 20 days. At Methone the bread was discovered to be bad; 500 men died of sickness thus caused and the fleet was delayed but the furnisher having influence at court escaped punishment. Procopius writes, "Bread distributed to the men should be put in the oven twice so it may keep longer,"¹ adding the bread had not been cooked properly the second time and fell into powder.

Now we have Procopius' words again, "From Methone the fleet proceeded to Zacinthus after taking onboard water to last when crossing the

⁹ From Constantinople to Heraclea is 60 miles, thence to Abydos 120. The itinerary given must be that of the war-fleet the dromons; the round-ships could not have entered port often.

¹ Hard tack as sailors called biscuit is very old: Pliny about 77 A D refers to, "Stale bread or sailor's bread beaten up and baked again;" bk 22, ch 25 (Bohn ed 6 vs v 4 p 447); in bk 18, ch 7 he says military bread is heavier by 1/3 than the grain from which it is made. Homer mentions grain and flour used in ships but not bread; he refers to, "Such men as know not the sea neither meat savored with salt;" *Odyssey* p 176 Butcher and Lang trans 1883.

Adriatic Sea. Thence having provided all necessary the fleet made sail and had so light a wind it required 16 days to reach a place on the coast of Sicily near *Ætna*. The water became bad on this passage except what Belisarius drank which his wife Antonina preserved by putting it in glass bottles and covering with sand so that the sun never reached it.”² From this port near *Ætna* Belisarius sent Procopius by land to Syracuse to learn as to preparations of the Vandals. Procopius met a friend lately returned from Carthage and brought him to Belisarius; upon hearing the friend’s report, “Belisarius praised Procopius much and ordered the trumpet sounded the signal for sailing. Instantly sail was made and the fleet touched first at Gozo and then at Malta. The next morning a levanter was blowing; this carried them as far as *Caput Vada* whence a man can easily walk to Carthage in 5 hours. When the fleet was all arrived Belisarius ordered the sails lowered and anchors let go. Then he assembled the chief officers in his ship to deliberate whether they should land.” No enemies were found here.

The speeches made at the assembly are given: the second-in-command first to speak says, “I cannot but admire the moderation of the general who surpassing us all so greatly both in talent and experience and invested with unlimited power yet refers to our common deliberations what his single wisdom might determine and his supreme authority command.” This officer inclines to the opinion they should go to Carthage in the ships; it being distant as the crow flies about 120 miles and by sea around the promontory we call Cape Bonn 200. Other officers speak but what they said is not given. Belisarius speaks as follows, “My comrades I trust you will not on this occasion look on my words as those of a master xx. All our thoughts all our prayers were limited to the single wish of finding a safe and unmolested opportunity to land in Africa and now that God has vouchsafed to us the fulfillment of this anxious wish would it be wise to neglect and spurn the very favor we so eagerly desired to obtain:” Procopius continues, “The council having followed the

² From Methone to Zacynthus now called Zante is 100 miles, thence to the shore of Sicily west 300 miles. This the fleet made in 16 days; 20 miles a day nearly. Why did not the Athenian fleet consisting of ships of much the same class sent to Sicily 900 years before (see above pp 143 and foll’g) go this way? Perhaps Belisarius knew better than Nicias the value of celerity, perhaps because the Athenian ships were mostly long-ships and many of those of Belisarius round-ships. The fleet of Athens depended in considerable part for food and water on the land; while Belisarius probably had supplies with him. If Belisarius’ fighting-ships were part-manned only with rowers as suggested above and were to sail for the most part his procedure is explained.

opinion of Belisarius the disembarkation was made at the same moment three months after the fleet had departed from Constantinople."

Here we leave the land army as we have no further concern with it though it fought more than once before its position was secure. Belisarius sent fleets to the islands to recapture them and before long was near Rome opposing the Goths there. It remains to analyze the course of the fleet: from Sicily to Caput Vada it sailed about 300 miles, the stretch from Malta to the latter place being 180 miles in the open sea; not so long as the stretch made from Zante to Sicily. The entire distance from Constantinople in a line from cape to cape is 1280 miles; their course could not have been less than 1600 to 1700 miles long. This they did in 3 months, 90 days; so if we take out 20 days for stops the fleet made good about 25 miles per day. It was a well managed affair from start to finish. The figures as to number and size of ships may be in error but there is no doubt the ships were larger than in the day of the Peloponnesian War else men and horses could not have been kept onboard so long. A War Council held afloat and runs of 180 and 300 miles in the open sea go to strengthen the probability of this: Themistocles' Council before Salamis was held onshore.³

A BATTLE OFF THE COAST OF ITALY IN 552.

So far we have no account by Procopius of a battle at sea but in the *Histoire Melee*, believed to have been written by him, there is one which runs,⁴ "Totila had sent a powerul army commanded by xx and ordered them to besiege Ancona. So they might more easily take it he sent 47 vessels to attack it at the same time by land and sea. After a time the inhabitants began to experience a want of food; this came to the knowledge of Valerian who was at Ravenna; being unable himself to succor them he wrote Jean the following letter:" the letter is given: "After

³ Above pp 124 and foll'g.

⁴ A trans of Hist Melee is in Cousin's Hist Constantinople v 2; the quotation is p 73. Totila Baduila as often called was Gothic King of Italy in 540; a gallant figure. In this v p 55 is the story of the beginning of silk culture in Europe; certain monks because Justinian prohibited his subjects buying silk of Persian merchants bring eggs of silk worms from China in manure contained in hollow reeds: p 72 a ship built of stone mentioned, the story is mythical and of the day of Homer but shows the notion of stone ships was familiar: p 71, "Totila manned 300 long-ships with soldiers and sent them to ravage Greece xx. They took Corfu and ravaged it and other islands as well and passed to the main-land xx. As they cruised along the coast they met a fleet of Greece where were some vessels loaded with provisions for the army of Narses." Narses a eunuch was sent with an army by land into Italy after the expedition of Belisarius.

Jean read this letter xx he embarked in 38 vessels the most valiant men and sailed at once. He came first to Scardone where Valerian also arrived and with 12 vessels. xx The Chief of the Goths informed of the coming of succor embarked in 47 vessels the flower of his army. xx When the 2 naval armies sighted each other they stopped and the Chiefs harangued their soldiers: "5 the speeches are given: "The chiefs having thus exhorted their soldiers they came to blows at once. The combat was furious and like one onshore. Prows were in one rank and opposed to prows and the soldiers fired with their bows incessantly. The most courageous fought with sword and lance and a *steady foot*. So the battle began but soon the barbarians unaccustomed to the sea fell into terrible disorder. Some of their ships separated from the main body others crowded so closely together as to incommode one another, their masts seemed interlaced like rushes. They could fire from a distance only with difficulty and when the enemy came near they had not room to use their swords and lances to advantage. They confused their own men by clamorous shouting, ship struck against ship sometimes pressing upon one another and sometimes withdrawing too much. If orders were given by the Chiefs they were rather to keep in proper position than to attack the enemy. It was principally due to the barbarians' want of experience that the Romans won the battle. As these knew how to use their vessels aright and to manage their arms they turned their prows toward the enemy, preserving a reasonable interval from one another and sank enemy's vessels separated from her consorts. They fired clouds of arrows into the places where the enemy was in disorder at times approaching and killing all with the sword xx. The barbarians no longer managed their ships, they no longer had the courage to stand on the rail of their ships to fight but abandoned all to fortune. Finally unwilling to shamefully fly most of their ships remained surrounded by the victorious fleet of their enemies. A few fled with 11 ships. All the rest fell into the hands of the enemy. Some the Romans cut to pieces others they drowned. They took one of the Chiefs the others escaped in the 11 vessels. To these the Goths set fire as soon as they landed, so that the Romans might not use them."

This is one of the best descriptions we have of the fighting of fleets of oar-ships. The battle occurred in 552 off Ancona, north-west across the Adriatic from Curzola and Lissa where battles were fought in the day of Marco Polo and in our own. Procopius describes it as Livy and others

⁵ Speakers and audiences must have been in ships.

describe combats of 700 to 800 years before; he does not allude to lashing ships of a fleet together, first mentioned as of 202 B C when Scipio's fleet was near Carthage. In battles between this and 552 A D; to wit that of Brutus off Marseilles 49 B C, at Actium 31 B C, between fleets of Constantine and Licinius in the Hellespont 323 A D, lashing ships in this way is not mentioned: yet it must have been approved for ships were lashed together in an action off the west of Greece in 200 B C, in the Mediterranean during the Middle Ages, and by the Northmen.⁶

THE ADVANCE OF THE MAHOMETANS ON EUROPE BY CONSTANTINOPLE IS
STOPPED BY THE GREEK FLEET ABOUT 675: AT THIS TIME
GREEK FIRE AN EXPLOSIVE IS USED IN SHIPS.

In 610 Mahomet proclaimed himself a prophet and in 648 his fleet seized the Island of Cyprus in advance on Constantinople and Christendom, which led in 655 to a great battle near Phoenix on the south coast of Asia Minor between Mahometan and Christian fleets, the former being commanded by Moawiah and latter by the Emperor of Constantinople in person. A modern author gives this account of the battle:⁷ the Roman ships under the Emperor advanced, "To a place in Lycia called Phoenix. xx The Emperor drew up his ships in line-of-battle and challenged combat. The ships met and the Romans were defeated and the sea was stained with the blood-streams of the Romans. The Emperor changed garments with another xx" and escaped. Following this the Mahometans besieged Constantinople with fleets in years 673 to 677 and 718.

GREEK FIRE.

In one siege here alluded to the Romans drove the Saracens away by using *Greek Fire* from their ships its use having been taught them by one Callinicus.⁸ The authors cited give the history of the origin of Greek Fire from which explosives have come. Lalanne refers to the writing of Nicephorus Patriarch of Constantinople about 815, 150 years after Callinicus brought the Fire to Constantinople: the Patriarch wrote,⁹ "The Saracens continued to besiege Constantinople for 13 months with many machines. There arrived at the same time for them a fleet under a

⁶ Pp 170, 491, 392.

⁷ Bury Hist Later Rom Emp v 2 p 290.

⁸ Feu Gregeois Lalanne p 15; Feu Greg Reinaud et Favé p 100; Later Rom Empire Bury v 2 pp 311, 319.

⁹ Const et Heraclius Nicephore, v 3 pp 375-8 Cousin's Hist.

general named Solyman:" this was about 675. The Emperor engaged the Saracen fleet with his ships and burned 20: our author proceeds, "The remaining ships arrived in the Bosphorus and passed the winter there xx. At the beginning of spring 2 more Saracen fleets arrived. The Saracen admirals were afraid to engage in the Strait for fear their vessels might be burned by the Fire they knew the Romans had xx. The Emperor sent ships carrying the Fire against the enemy's fleet and burned them entirely." Just beyond this passage is another by Nicephorus regarding Fire used by a Greek fleet against Saracens in Cyprus.¹

Greek Fire the fore-runner of explosive substances appears at Constantinople not far from the year 675. The characteristic that distinguished it from burning mixtures is that it could project itself or another body, for if the elements necessary for combustion are close together a substance will burn very fast and if conditions are suitable will explode. The burning compounds used in ancient warfare were many but until Greek Fire they drew from the air the necessary oxygen and burned slowly. We come to this again,² noting here the Fire brought to Constantinople by Callinicus in 673 was not used in a gun but burned so fast that like the jet from the fire-work we call a Roman candle it projected itself. It contained an ingredient like saltpeter carrying oxygen. It had in early day many names of which the English equivalents are sea-fire liquid-fire fire of artifice Greek fire Roman fire Medic fire etc. As to whether the story that Callinicus brought the substance to Constantinople about 675 or invented it in that year, a question curious rather than important, writers do not agree.³

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THE MAHOMETANS OVER-RUN THE NORTH OF AFRICA CROSS INTO SPAIN AND
WIN THE ISLANDS OF THE MEDITERRANEAN.

The Mahometans passed west along the north of Africa and crossed into Spain at Gibraltar in 711, the Rock at the great ocean-gateway being captured by them under Gibel-el-Tarik in that year. Their advance from Gibraltar was not withstood until in 732 by Charles Martel at the Battle of Tours where they were beyond the Pyrenees and deep in Christendom. Never was Europe in so imminent danger. It is not too much to say they would have entered 50 or 100 years before by way of Constantinople but

¹ P 387 v 3 Cousin.

² P 381.

³ Lalanne Feu Gregeois p 15; p 16 as to its names.

for East-Roman ships. If that city had been supported by Christian nations against the Turks 600 years later instead of despoiled by them the Turks would not have taken the city and occupied it until now; would never have secured themselves in Europe.

Very early the Mahometans cast eyes on the islands and the Mediterranean became the scene of robbery murder burnings and capture of persons in ships and islands, even on the main-land, and bearing these off to row in galleys or fill harems. A Saracen fleet attacked Sicily the key to trade in the Mediterranean in 632 the year Mahomet died, and struggles regarding this island occurred for 200 years when at length in 827 the Saracens occupied it:⁴ they held it till 1092 when a Norman fleet drove them from it. In 648 Saracens seized Cyprus as necessary to advance on Constantinople but remained there a short time only, apparently only until failure of their assault on Constantinople.

This failure ended Saracen advance in the East and thereafter their sea-operations were in the West. In 725 they obtained possession of Sardinia and not long after occupied Corsica and Crete; about 900 they set up a piratical colony on the main-land between Nice and Monaco and maintained it for 100 years.⁵ Of the islands Crete next to Sicily occupies the most important position as to passing ships; it was captured by the Saracens in 823, and emperors of East-Rome sent several fleets to drive them out for they preyed from its harbors and inlets on passing Christian ships inflicting much loss.⁶ A fleet was at length successful, for the Emperor Nicephorus Phokas assembled 300 sail carrying stores and siege engines in the year 960 which captured the island: we are told it became necessary to stop supplies and food coming to the garrison and the Greek fleet,⁷ "Maintained a strict blockade during the whole winter. When the weather permitted light galleys cruised before the port and at all times several of the swiftest *dromons* and *chelands* were kept ready to pursue any vessels that might attempt to enter or quit the port."

⁴ Hist Invasions des Sarrazins Famin p 149: occupation was effected by 100 vessels carrying 10000 foot and 700 horse which sailed June 827 from Africa; it crossed in 3 days. P 347 this work is given trans of writing of the monk Theodosius as to mil operations of Saracens in Sicily; they brought throwing-machines but used them only after landing.

⁵ Hallam Hist Eur in M Ages Colonial Press v 1 p 18; see also Famin's work cited note next above.

⁶ Since the day of Minos 1200 B C Crete had been a great emporium: above p 112.

⁷ Finlay Hist Greece v 2 p 318; Jal's def of *dromon* is above, n 7 p 371; the name *cheland* for a type may be very old indeed (see above p 198); here it means an armed ship.

THE MILITARY INSTITUTIONS OF THE EMPEROR LEO THE WISE.

Just before Nicephorus Phokas Leo VI surnamed The Wise was Emperor of East-Rome reigning 886 to 911. He wrote a book he called Military Institutions⁸ and says much of ships throwing-machines and Greek Fire. The history of projection will be placed by itself⁹ and here only what is said of ships. The date of Leo must be borne in mind; about 900 A D, 1400 years after Greeks wrote of oars in several horizontal lines and 300 years before the date when the *triremi* of Venice had 3 men on each side on her level thwarts, each with his own oar; zenzile rowing.

Institution 19 is of Combats on the Sea, "Of which," Leo writes,¹ "We find nothing written by ancient tacticians. First you must learn pilotage and the conduct of vessels to know the different quarters of the winds the movements and aspects of the stars the revolution of the sun and moon which change the seasons and to foresee the variation of the weather. You will place at the front a *siphon* covered with brass to launch fire on the enemy. Above the siphon a wooden platform must be built surrounded with a parapet. Soldiers to fight and discharge arrows will be placed here. On the large dromons castles of wood will be elevated on the middle of the deck. Soldiers placed there will throw on the enemy great stones or masses of pointed iron by the fall of which the vessels will be broken or those there crushed, or they will throw fire to burn them. Each dromon should be long of a width proportional to its length with 2 ranks of oars one *above* the other *below*. For each rank there should be at least 25 seats to seat the rowers namely 25 below and 25 above, and on each one there should be 2 rowers, one to the right and the other to the left, which makes in all 100 men rowers or soldiers. xx The last 2 rowers toward the prow are destined the one to be *siphonator* the other to cast the anchor xx.² Larger dromons containing as many as 200 men may be

⁸ Larger libraries have it in Greek and Latin. There is a French trans by Maizeroi of which the only copy in this country was not long since at the Army War College: the Philadelphia Library procured a copy well-printed and bound for a few dollars and the N Y Public has ordered one. Without this book the history of war cannot be understood.

⁹ Pp 435 and foll'g below.

¹ Pp 135-7 v 2: he is mistaken, Herodotus Thucydides all authors wrote of combats on sea.

² There follows an involved passage which has been omitted; it indicates there may have been a rudder and a pilot at both ends of ships: see below pp 518-19 for ships of 1700 A D thus fitted.

built even more if necessary. Fifty will be for the *lower* seats and 150 for the *higher* ones *who are all armed to fight*. Smaller vessels of a single rank of oars will be made which are called *galíots* which are very rapid; they will be used for guard discovery and all expeditions where celerity is necessary. xx You must also have vessels-of-burden. xx You will choose *robust and willing* soldiers above all those who are to be for the *party above who may fight the enemy*. If there are *weak ones* of little value *leave them below*. From these also you will draw to replace those wounded above. xx Your galleys must not row without order but you will divide them into squadrons of 3 or 5 over each of which there will be a chief."

The mention of *siphons* to launch fire will not be overlooked. From these the fire was projected on the enemy; they required to serve them only one man.³ Further evidence as to the character of the Fire is below. Leo's ships carried throwing-machines; swinging-beams since large stones were to be thrown and cross-bows since pointed projectiles were used. These were mounted in the castles of wood he orders.

It seems impossible to conclude from the words otherwise than that his ships used oars at more than one level; yet we know that 300 years later in Venice and therefore throughout the Mediterranean rowers were in one level, zenzile fashion.⁴ Just beyond the words quoted comes a passage which shows oar-ships of the day formed camps onshore in which the crews lived; thus proving ships not materially more habitable than those of ancient Greece and Rome.⁵ As to battle formation the Emperor writes,⁶ "You can form your fleet in a crescent the galleys placed on this side and that advancing like 2 horns; you should place the best-armed at the points. The commander will be in the middle of the concave whence he can see everything and give orders. This semi-circular formation is the best to envelop the enemy; xx many of the ancients have used this formation xx."⁷ You may also form in a straight line. By this disposition you bring your prow on the enemy to burn his vessels by the fire thrown from the siphons. One may form in 2 or 3 lines. We have from

³ Lalanne Feu Greg pp 20, 21; the fire proceeded with noise of thunder and enveloping flames; see below p 381.

⁴ Above pp 77 and foll'g.

⁵ P 148 v 2 of Leo.

⁶ Pp 154-61 v 2.

⁷ From what follows it results that galleys turned about when reversing directions; if they had a rudder at each end of which the possibility has just been indicated they would not do this.

the ancients as well as the moderns many expedients to destroy the enemy's vessels. Such as the fire prepared in the siphons from which it is discharged with the *noise of thunder and enveloping flame which burns the vessel against which it is directed.*"

The last words describe an explosive and mean that besides burners, sulphur bitumen or similar bodies which were used when we first hear of war, there was an oxygen-carrier in the mixture; saltpeter or some other. The burner, carbon or similar substance, was lying close to oxygen; when touched by flame it burned so fast it jumped about projected itself as far as any object the gas came off strongly enough to reach. But it is still a long cry to gunpowder ready to push 50000 pounds to the square inch and no more; for the gun will burst if this is exceeded. It is the greatest force employed in the arts. We are so used to considering guns able to withstand powder we hardly think about it, but the want of a gun delayed for long the development of gunpowder. The indications are that explosives were used in Europe by about 600 A D and earlier in Asia but there was no gun until 5 or 6 centuries later. As the words of the Emperor given are important in the history of explosives the following translation by Lalanne is included; ⁸ "There are many other ways of fighting some devised in ancient days and some in our day by men skilled in military art. Among these is the *feu d'artifice* which projects itself from tubes and which preceded by loud noise and smoke burns the ships." Besides this passage 5 others of similar character are translated by Lalanne and given at the same place in his *Feu Gregeois*. The translation by Maizeroi of these is in the present work either just above or below. Lalanne's translations of Leo's 5 passages are, (1) "There should be always at the bow of the ship a tube lined with brass to project the *feu d'artifice* upon the enemy;" (2) "Of the two bow oarsmen one must be the *siphonator*; (3) One may use the fire in another way, by means of little tubes thrown by the hand and which the soldiers will hold behind their bucklers. These are called hand-tubes. They should be filled with *feu d'artifice* and thrown in the faces of the enemy;" (4) "Above all we recommend throwing on the enemy pots filled with *feu d'artifice*, these on breaking will set fire to the ship;" (5) Lalanne adds, "As a chapter of Leo's work devoted exclusively to Sieges does not mention Greek Fire we may suppose that at about 900 it was used only

⁸ P 20 Lalanne's *Feu Gregeois* where the Greek will be found: from this names by which the substance was called may be seen.

in sea warfare." One of the Fire's Greek names was *pur thalassion*, sea fire.

To resume Maizeroi's translation:⁹ "Archers should be placed at the bow poop to starboard and port to discharge little arrows called flies. xx Also you may throw vases full of unslacked lime xx and burning material which break on falling and set fire to the vessels. You must use little hand-siphons which the soldiers carry behind their bucklers and which we make ourselves; they enclose a prepared fire to be thrown in the faces of the enemy; xx also wooden spheres provided with iron points. They are surrounded with tar and sulphured cloths and after being lighted are thrown in the vessels to set them afire xx. You should also throw with a *mangonel* liquid and burning pitch xx." Mangonels were throwing-machines. There is another passage to strengthen the supposition oars were in more than one level; this reads,¹ "I think it would be well that from the lower oar-seats long pikes should be thrust through the oar-ports to kill the enemy. It would be well also to find means to make water enter by this place into the enemy's galley."

There exists record of throwing or spouting fire in later day: Cinnamos a Byzantine who lived 300 years later than Leo wrote of a fleet-action between Byzantines and Venetians,^a "The Byzantines pursued them as far as Abydos and endeavored to burn them by throwing fire, but the Venetians accustomed to this fire had covered and surrounded their ships with woolen stuffs saturated with vinegar. Thus the fire xx thrown from too far either did not reach the ships or reaching the woolen envelops was repulsed and falling into the water was extinguished." We hear of it again in a fleet of Peter the Great in 1724, "Some new inventions were devised of the combustible kind for destroying ships and xx 2 vessels furnished with fire-spouts or engines spouting liquid fire and just before the fleet sailed the Tsar ordered boarding-bridges to be fixed with hinges to the gunwale of every ship."² Here are the boarding-bridges Herodotus says were at Mycale 479 B C and Duilius' corvus of 260 B C.³

The Emperor confirms not a little of what Vegetius ⁴ of more than 500 years before wrote; saying much like his predecessor, "Other wagons

⁹ Top p 381 above.

¹ V 2 p 162.

^a Lalanne Feu Greg p 30.

² Eng Navy Rec Soc 1899 p 28. Fire-throwing in the late war will not be entered on.

³ Above pp 178 and foll'g.

⁴ Above pp 363 and foll'g.

carry *toxobalistæ* with their arrows and *balistæ* or *mangonneaux* called *alacatia* which are bent by windlasses;" ⁵ also, "You will throw also from the mangonneaux called *alakatia* packets of tar bound to arrows or stones full of burning material." ⁶

ANNA COMNENA.

Another royal personage and dweller in Constantinople is the next chronicler; Anna daughter of Alexis Comnenus East-Roman Emperor 1081 to 1118. Anna's was the day of Constantinople's splendor and commercial extension: Finlay writes that in 867 to 1057, "Byzantine commerce filled the whole Mediterranean and legitimated the claim of the Emperor of Constantinople to the title of Autocrat of the Mediterranean Sea." Shortly after her day decline began and shipping was suffered to diminish until in 1204 the city was captured and looted by Christian Crusaders coming in a fleet hired at Venice.⁷

Anna's book is called the History of the Emperor Alexis Written by Anna Comnenus and a French translation will be found volume 4 Cousin's *Histoire de Constantinople*. Alexis was one of the few emperors of East-Rome whose reign ended with natural death for the customs of the court were ferocious and deceitful, but those who read Anna's History will conclude she was an honest good woman. Her mother Irene wished the father to set aside his oldest son and make Anna and her husband sovereigns but while her history alludes to this from time to time she evidently takes little interest. She was eye-witness to none of the events bearing on the sea to which she alludes. At the end she wrote;

"The learned Anna has finished her history
For death has won over her father the victory."

Robert a Norman prince came to Sicily with a fleet in 1058 and drove the Saracens from the island. It was the day of the empire-building of the

⁵ Maizeroi trans p 79 v 1. *Toxobalistæ* were cross-bows: *toxon* is Greek for a bow for shooting a rainbow, it occurs in Homer: *alacation* is also Greek; it means *balista*. As wagons carried these in the day of Vegetius and Leo, 375 and 900, both were familiar with field artillery. *Mangonneaux* is derived by Jal from *magganon*: the last is a siege machine; the word occurs in the mil work of Emp Maurice of Constantinople 582-602 and was used in several variants throughout the M Ages to signify a throwing-machine, always of the swinging-beam kind. See below p 459 n 3 as to writings of Maurice.

⁶ P 11 v 2.

⁷ Finlay Hist Greece v 2 p 10; p 16 this v is narration of the repulse of the Saracen fleet before Constantinople in 717 by Greek Fire. The attack of Crusaders on Constant in 1204 is below pp 410 and foll'g.

vikings and Robert's successors ruled the island until 1266 when it was conquered by the French. The Normans aided by Pisa Genoa or Venice at times tried to extend their empire across the Adriatic by winning part of the domain of the emperors at Constantinople. Anna writes Robert made preparations to cross the Adriatic,⁸ "Assembling 150 vessels and 30000 troops he put 200 men in each ship without arms and horses xx. Before sailing he sent men who captured Corfu a considerable city and many near-by places xx and thus amassed an immense sum." We read again as to this expedition,⁹ "Robert built towers on his ships covering them with hides and embarked his soldiers horses and machines for sieges, preparing with diligence everything necessary to carry over-seas xx. When ready his ships went to sea ranged in good order and were carried by a favorable breeze to Avlona:" the distance is 120 miles. On the east side of the Adriatic when reached by the fleet a violent wind arose: "The impetuosity of the waves broke the oars in the hands of the rowers split the sails broke the lateen yards, and engulfed the ships with the men and all aboard them."

The Venetians were induced to send a fleet to join the Emperor and the war continued until the death of Robert in 1090. We have from Anna the following account of a Venetian fleet,¹ "As their great-ships were becalmed they attached them to each other in a half-moon and raised towers placing soldiers with thick short arrows with sharp points in these and awaited the enemy. xx The enemy charged with great impetuosity but the Venetians struck an enemy's ship with such force with a heavy tree-trunk as to bring her to a sinking condition." Later Robert's fleet is held in a river by the stream lessening in depth; he sinks,² "Two rows of piles in the 2 sides of the river filling with basket-work the space between and throwing behind all pieces of wood stones and sand so that the water being closely confined rose enough to carry his ships to the sea."

At the same date we read of Greek Fire blown under water against a ship, submarine projection; Robert's ships are fighting some of Venice and East-Rome and the last,³ "Craftily blowing the Greek Fire under

⁸ P 54 v 4 Cousin's Hist.

⁹ P 115 same v. The hides were to protect against fire.

¹ P 121 same v. The "great ships" are round-ships driven by sail carrying stores soldiers and horses.

² P 123 same v.

³ Barlow Normans in South Europe p 171: the battle was off Dyrrachium in 1084. The author given as authority is, "Gaufredus or Geoffry surnamed Malaterra a monk of the order of St. Benedict." See p 453 n a below.

water through hidden pipes treacherously burned one of our ships under the waves of the sea." The Normans may never before have seen the Fire. This early use of what must have been very destructive to wooden ships is not without confirmation for in another work is this,⁴ "A Sicilian author who wrote a history of Robert Guiscard recounts that in the naval battle the Doge Domenico Silvio had with this prince before Dyrrachium in 1084 the Venetians used a fire that burned in water and which was attached to the vessels below water." The words show an explosive was used for only explosives will burn under water. The origins of submarine warfare may lie much further back however for Herodotus possibly alludes to it at the time of the Persian invasions of Greece.⁵

COMPOSITION OF FLEETS.

As to the make-up of fleets a passage from the History of the Crusades written by William co-temporary Bishop of Tyre may be quoted,⁶ "The Doge of Venice Dominique xx and other great persons of Venice raised a fleet of 40 long-ships, 24 larger ships and 4 larger still, destined to carry great weight; xx in the fleet were some ships provided with spurs, all provided with 100 oars each one of which required 2 men." The long-ships fought a battle off the coast of Syria and came off victors. As there were 2 men on each oar this was *scaloccio* rowing.⁷ The round-ships, ships-of-burden, carrying food troops and military stores, were in number $\frac{7}{10}$ the number of long or fighting ships; in aggregate tonnage they were probably 2 or 3 times that of the latter: see below p 398 n 8 as to round- and long-ships in Norse fleets of the same date.

ANNA'S STORY CONTINUED.

Our authoress rarely dwells long on a subject and all she says of sea affairs is in fragments. She touches on what we call marksmanship, a thing ancient authors rarely refer to but which must always have been highly valued. In preparing for battle the Emperor Alexis, "Concealed in his advance-guard and in the phalanx of foreigners a number of soldiers

⁴Daru Hist Venise 8 v s 1826 p 348 v 3.

⁵Bk 8, 8: he tells a tale of a man swimming 10 miles under water; "In my opinion", he adds, "he came in a boat."

⁶Hist Guillaume de Tyr in Coll Mem Rel Hist de France Guizot 1824 p 233 v 2: Domenico was doge 1117-30: see below p 387 as to long-ships hauled over land and immediately below for ships of 6 to 8 feet draft.

⁷Above p 75 n 1: according to our authorities it is a very early date for this way of rowing.

who had particular skill in shooting to fall unexpectedly on Robert; and gave orders the ranks should be opened to allow these to pass and closed again immediately.”⁸ On the next page it is recorded that in fighting Robert’s men when repulsed, “Retired in disorder towards the sea which many entered until up to their necks but were unable to reach their ships.” If the ships were as close to the shore as the depth would allow they were of 6 to 8 feet draft. On another occasion Venetian ships having advantage over Robert’s the latter is not discouraged but fell on them again; the Venetians are disconcerted by the unexpected attack, “But did not fail to attach their great ships together putting the small vessels inside. The battle was furious xx, but as the Venetian ships had consumed the provisions they carried their vessels being thus without their usual load they floated unevenly on the sea, and thus when the soldiers all crowded to one side to fight the enemy’s ships they capsized and sank. There perished thus 13000 men. The rest of the ships were taken by Robert’s fleet.”⁹

Anna pays her respects to astrology; the mother of astronomy it has been called for its pursuit led to the science of astronomy: of a certain prediction she writes.¹ “Eudoxus Plato and Manetho did not know astrology. These great men who penetrated the secrets of nature never learned the art of casting horoscopes nor drawing a figure nor fixing the point of birth. I have had the curiosity to learn something of this art; not to know the future God preserve me from so dangerous a superstition but to contend with the vanity of those who make this profession. I write this not vainly but only to show how much the sciences have prospered in the reign of my father who loves philosophy and philosophers. He has only aversion for judicial astrology being persuaded it undermines the trust men should have in the power and goodness of God by leading them to look for their happiness in the dispositions and influence of the stars.” It appears however the Emperor not infrequently consulted astrologers.

Here is a passage showing ships were bound together in fight: fleets come within sight of each other and the commander of one is,² “Astonished

⁸ P 130 v 4.

⁹ P 170. The story is not improbable. The large ships were lashed together in a circle; they were round-ships short and broad, but if emptied might fall over on their side even in smooth water. Sailing ships of recent days did this occasionally. The small vessels inside must have been war-ships long and lean.

¹ P 174.

² P 219; the date is 1090.

at the novel arrangement of the enemy's fleet; for its ships are attached to each other by a chain so that they cannot separate nor leave the line nor advance." This is mentioned not infrequently both before and after Anna's day. In her day the army of the First Crusade preached by Peter the Hermit in 1094 passed through Constantinople; "The irruption was portentous," she writes,³ "All the West all who live from the Adriatic Sea to the Columns of Hercules all Europe so to say seemed aroused against Asia. xx The army was followed by a multitude of people like the sand of the sea or stars of the firmament. They carried palm leaves in the hand and wore a cross on the shoulders. Even women and children had left home to perform this journey. They passed everywhere like streams joining to make a great river. Most came by way of Hungary." This unorganized body captured Jerusalem by assault July 1099, but its first success was capture of Nicæa in Asia Minor not far east of the Bosphorus. The part played by ships in the capture was important; William Bishop of Tyre writes of it,⁴ "Ships of middling dimensions were found the Emperor's permission to draw them from the sea was easily obtained and they were hauled up dry on the shore. Then attaching one to the other 3 or 4 chariots according as required by the length of the vessel the latter were placed thereupon. In the space of one night they were dragged to the lake at a distance of 7 miles or more employing the help of cables and the multiplied efforts of men and horses. Among these vessels were some containing from 50 to 100 fighting men." The rowers of the ships are no doubt extra above these. Nicæa was taken June 1097.

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THE CRUSADERS WERE FEARED IN CONSTANTINOPLE.

The Emperor feared the great horde of Crusaders for our author writes,⁵ "The Franks had taken several places in Syria and offered large sums of money to the Bishop of Pisa if he would supply them with means to retain their conquests by loaning them ships. He assented to this and with 2 others collected galleys and other light vessels to the number of 900. These he brought near to Jerusalem leaving enough on his way to guard Corfu Zante Lencadia and Cephalonia. News of this led the Emperor to order all the ports of the Empire to build vessels and to make

³ P 289 same v.

⁴ P 137 v 1 his work cited n 6 p 385 above.

⁵ P 337 v 4. By Franks she means people of Western Europe. P 333 same v is narrated the fortunes of an army of Northerners said to number 100000 foot and 50000 horse which passed by land by way of Constantinople.

them at Constantinople as well where he excited the emulation of the workmen by his presence and himself prescribing the art and manner of working. As he knew the Pisans were strong on the sea he fixed on the bows of his vessels lion's-heads made of bronze to vomit fire to frighten enemies. He gave the command of these vessels to Tatice who had lately come from Antioch honoring him with the title of Most Illustrious, that of the rest of the fleet he gave to Landulphe an experienced seaman. They sailed from Constantinople in April and passing along Samos came to the continent opposite to repair. Learning here the Pisan fleet had sailed they followed toward Cos where they arrived in the evening and learned the Pisans had left that morning so they sailed to look for them at Cnidus an island near the main-land of the east. Here they found a few Pisan ships, they asked them where were their consorts and learning they had steered for Rhodes they made sail for that island. When the Pisans saw them coming they ranged their ships in good order and prepared for the combat. As the Roman fleet advanced a Count a native of the Peloponnesus pushed his ship at her full speed of oars into the middle of the Pisan fleet traversing which with an impetuosity beyond belief he returned to his own fleet. The latter began the combat in confusion and disorder. Landulphe advanced first and spouted ⁶ the fire with such imprudence it was dissipated without harming the enemy. The Count Elemon attacked a great vessel and his rudder becoming disabled was in danger of capture; to extricate himself he had recourse to the fire which he ejected ⁷ with such skill and address as to burn the enemy's ship he was fast to and 3 others. Then the wind suddenly changed xx the waves rose the lateen yards made a dreadful noise and the sails were split. The Pisans were astonished at the violence of the tempest but still more at that of the fire, for unlike ordinary fire which naturally goes up the artificial fire goes down sometimes to one side and sometimes to the other as directed by those who eject it. This obliged the Pisans to fly xx. The Pisans who escaped turned to piracy ravaging the islands principally Cyprus." ⁸

A fleet was prepared at Brindisi by the successor of Robert Guiscard:

⁶ The French is *jetta* which may be translated thrown as well as spouted. The essential point is whether the fire was *self-projecting*; as to this see Anna's words below.

⁷ The French is *lanca*; like *jeter* it may mean to throw.

⁸ A year later the Emperor prepared his fleet against the Genoese who were coming to the aid of the Franks in Syria; the description, see p 347 same v, is very indefinite.

Anna says its leader,⁹ "Had around him 12 vessels with 2 ranks of oars full of rowers, when they rowed they made a frightful noise. Great round-ships served as a wall to guard and defend the fleet. At a distance one would suppose the fleet a moving city. They had a light breeze from the south which moved the great ships at the speed of the galleys. The noise the fleet made could be heard on both banks and the spectacle was terrifying. xx Landulphe¹ considering its greatness and power wisely withdrew without disputing its passage xx." The fleet comes to land and the army lands and assails a number of small towns and lays siege to Dyrrachium. But although the besiegers have many machines they are unable to reduce the city and, "Push a mine under the wall covered by turtle-backs which guarded them from arrows and stones from the walls of the city. xx The besieged start a counter-mine whence they could hear the foundations of the wall being sapped. Through slits they saw multitudes of Franks and threw in their faces a fire I will describe: pines and other trees which are evergreen produce a gum which is pounded fine and mixed with sulphur. The mixture is put in reeds at the end of which is put the fire. The besieged blow in these reeds and throw the burning material in the faces of the Franks who fly like bees stifled with smoke."² Just beyond our author says when telling of the height of the towers and length of the scaling-ladders of the Franks, "I believe these barbarians understand optics for without this science they could not have measured the height of the walls so exactly."³

WAR MAPS.

Anna says of maps of the theater of war,⁴ "The Emperor xx ordered prepared a map of the enemy's coasts whereon were marked the ports and places where Roman ships were to be stationed to stop the ships of the Franks and with which wind to sail and sent it to the fleet with simple

⁹ P 366. It shows the customs of the day that the Emperor told the commander he will blind him if he fails to find and defeat the enemy.

¹ The Emperor's admiral. Anna must mean the noise the fleet made could be heard on both sides of the Adriatic.

² Pp 376-7. This is probably not an explosive.

³ In De Rocha's paper Instr de Geodesie etc La Nature no 511 Mch 1883 is described and illustrated an instrument of Heron of Alexandria who lived 250 B C. Two bars are hinged; one is directed at the top and the other the base of a wall and from the outer end of the first hangs a plumb-line. This would give the height of the wall if the distance to it were known. The learned in Constantinople must have known of this device; it was called *luchnia*, lamp.

⁴ P 387.

instructions." It is not said differently colored pins were used to represent different forces but is not unlikely.

THE NAVY IN POLITICS.

Naval forces have rarely been involved in matters of politics but the fleet aided in enthroning Alexis the father of our authoress as Emperor.⁵

MAINTENANCE OF FLEETS.

In the days we are dealing with war was becoming a business that supported itself. The Persian fleets that came to conquer Greece were raised and supported by Government and this continued in the days of Greece and Rome and fleets and armies when in countries not their own have always taken what they wanted and were able to lay hands on. The Crusaders who passed through Constantinople like the sand of the sea or stars of the firmament as Anna put it must have lived on the country for there was no commissariat. Fleets and armies lived by their wits and strong arms during the Middle Ages and their pay and support was in the hands of commanders. Under these circumstances there was no better way to bring an army or fleet to a stand than to lay waste a territory before it and parts of allied forces were continually fighting about food or riches seized by one and coveted by all. During the Holy Wars in Syria for 200 years and more the Crusaders of each nation were against all others; Catalan Genoese Sicilian Norman Byzantine Venetian Egyptian English Flemish ships and fleets had necessity first to live; friends one day were enemies the next if one possessed something needed or coveted. It will be evident as we review wars that until about 1600 fleets supported themselves; the *condottieri* who fought as a livelihood were on the sea as well as land. It was not their interest to bring a war to an end or allow themselves to be killed or badly wounded, so they spun operations out as long as possible and enforced rules to prevent fighting being too dangerous.

What precedes back as far as page 362 showing how large and effective were war-fleets from the battle of Actium until about 1100 shows the fighting ships in the 1000 years following the beginning of the Christian Era were numerous and capable; it follows that the ships engaged in peaceful pursuits were numerous and capable and that there was no Dark Age in affairs of the sea.

⁵ Pp 75 and foll'g.

THE NORTHMEN.

The ships and ways of Norse seamen were developed in their own ocean. Their first essays were no doubt made in enclosed waters but the craft we know were developed in the sea and differed from those of the Mediterranean. The coast of Norway is indented by inlets and fiords and with numerous islands near shore and pilots plying in this varied and beautiful region must have had from remote antiquity maps showing the situation and form of islands and coasts. Any-one who could draw and men begin to draw at very early stage of development could put what the pilots knew on a horn or parchment. Voyages were made within the islands in stormy and thick weather by noting the run the ship made and checking up with the chart as ships now run along a coast from one harbor to another without seeing land.⁶ The ships of the Northmen show at a glance they were more seaworthy than vessels built in the Mediterranean and yet in their ways they were much the same; in both regions ships went to the land and left it with extraordinary facility and used oars and sails; we shall come on a Northern ship using oars at more than one level; and the records show they built round- and long-ships. The ships which Sigurd brought to the Holy Land in 1100 were long-ships;⁷ those in which explorers crossed the Atlantic were probably long-ships, for round-ships are not fit for work in unexplored waters; but the packet-service between Norway and Greenland from before the beginning of the Crusades until after they were ended, from 500 years before Columbus crossed the Western Ocean until the day of that event, were round-ships. The seas were known and heavy freights including live cattle were to go and for such purposes round-ships are suited. Further if blown away and a long while recovering land the crews of round-ships would not die of starvation or thirst; and food could usually be cooked. A fire could be lighted in a round-ship when this would be impossible in a long-ship.

Thus the first voyages of the Northmen to Greenland and America along the north of Europe and west and to the Baltic and Mediterranean were in long-ships; *langskip* the Northmen called them. They could not have gone in Greek or Roman long-ships; but the northern vessel was

⁶ The steamboats on Long Island Sound do this: it was the boast of captains running from Valparaiso to Panama they could go in fog entering numerous intermediate harbors without seeing the land.

⁷ Above p 235. The ships in which King Richard came to the Holy Land about the same date were also long-ships. English and Norman ships of the day were very like.

sturdier, of heavier scantling throughout, and while not as fast with oars she was better with sails. When fleets fought ships were bound together and warriors fought with stones bow-and-arrow swords and spears. When in a battle the ships' stems being bound together it was noticed the King's ship longer than the others had her stern out of battle, the King made them lash with the bow of his ship projecting towards the enemy by bringing the sterns fair with one another. This ship was provided with, "An iron beard or comb above on both sides of the stem and below it a thick iron plate as broad as the comb which went down quite to the ground."⁸ Of a great fleet of Canute who became King of England in 1017 it is stated it comprised 1200 sail; it, "Required a good deal of room at sea and there was a long distance between the foremost of the ships and the hindmost and between those outside and those nearest the land," Of this fleet a saga says,

"Side to side
The long-ships ride
Along the yellow strand.
Mast to mast,
All bound fast,
The great fleet lies in ranks ;"

and again,

"Earl Swend his ships of war pushed on
And lashed their stout stems one to one."⁹

The 1200 vessels in Canute's fleet were no doubt for the most part small but included large ships for the saga says "He had a vast number of men and ships frightfully large. He himself had a dragon-ship so large that it had 60 banks of rowers and the head was gilt all over. Earl Hakon had another dragon of 40 banks xx. The sails of both were in stripes of blue red and green xx. They had also many other huge ships remarkably well fitted out xx. When the Swedes saw Canute coming they *struck their tents* put on their weapons rowed out of the harbor and east around the land *bound their ships together* and prepared for battle."¹ A bank was the space between 2 thwarts ; in each there were 4 to 8 men and thus a ship

⁸ Heimskringla trans Laing 3 vs 1844 v 3 pp 475, 474 for these citations. The beard was an obstruction to the enemy's boarding.

⁹ See Laing v 2 pp 267, 248, 242, 44.

¹ Laing v 2 pp 242, 248. The tents struck may have been the large canvas covering ships were fitted with or tents onshore.

of 40 banks mustered 320 to 640 men. Another test may be applied; banks must have been $2\frac{1}{2}$ to 3 feet apart to allow men to row and thus the rowing chamber would be nearly 180 feet long, which making allowance at bow and stern, would mean a ship some 225 feet long. Laing concludes a long-ship of 34 banks of the year 1000 was as long as an English 42-gun frigate of 1840.²

THE WAYS OF NORTHERN SHIPS.

Below are given passages in Laing's translation: many are in verse and as they represent the ways of ships a number have been included. Norman ships sailed and rowed; their crews often landed or changed from ship to shore or the reverse in battle and yet it was possible to live onboard: the following shows much of them:

“ My lovely girl! The sight was grand
 When the great war-ship down the strand
 Into the river gently slid
 And all below her sides were hid.
 Come lovely girl and see the show!—
 Her sides that in the water glow
 Her serpent head with golden mane
 All shining back from the river again.”

Then the ships are rigged and prepared for sea and it goes on,

“ It was upon a Saturday,
 Ship-tilts were struck and stowed away,
 And past the town our dragon glides
 That girls might see our glancing sides;
 Their oars our Kings-men handle well,
 One stroke is all the eye can tell,
 All level o'er the water rise;
 The girls look on in sweet surprise,
 Such things they think can ne'er give way.
 They little know the battle-day;
 'Tis in the fight not on the wave
 That oars may break and fail the brave.
 At sea beneath the ice-cold sky,
 Safely our oars o'er ocean ply;

² Heimskr v 1 p 135.

And when to Drontheim's holy stream
 Our *seventy* oars in distance gleam,
 We seem while rowing from the sea
 An erne with iron wings to be.”³

The ship-tilt was a tent covering her from end to end under which the men slept; it hung over a ridge-pole very probably the mast. As to sailing we read of King Magnus, who reigned 1035-47;

“ Brave King the terror of the foe,
 With thee will many a war-ship go.
 Full seventy sail are gathered here
 Eastward with their great King to steer.
 Sails swell yards crack the highest mast
 O'er the wide sea scare seen at last.”

And again;

“ I can relate how through the gale
 The gallant Bison carried sail
 With her lee-gunwale in the wave.”⁴

As to sleeping in ships;

“ Here let us anchor in the stream;
 In Godnar fiord we'll safely moor
 Our sea-homes and sleep quite secure.
 In next summer I foresee
 Our anchorage in the south will be
 To hold our sea-homes to the ground
 More cold-tongued anchors will be found.”⁵

The ships were at sea in winter;

“ The Norseman's King is on the sea;
 Tho' bitter wintry cold it be
 On the wild wave his Yule keeps he.”

³ Heimsk v 3 p 56: if the 70 oars mean 35 on a side as is probable, and if she rowed scaloccio, as is perhaps certain, for there is no mention of zenzile rowing in the North, she was a ship such as just described, of 225 feet length and 25 beam: her draft was about 8 feet.

⁴ V 2 p 378.

⁵ V 3 p 30.

The same is here stated ;

“ On the thundering wave
The King’s men brave
Stay-ropes make fast
’Gainst the wild sea blast ;
Close-reef the sail,
The water bale,
And brisk the yards swing
While the sea and sky ring.”

“ By the cold white crest
Of the waves oppressed,
The ship scuds fast
In the wild sea blast.
The King’s men save
Their ship from the wave,
And on Calmar’s strand
Their brave King land.”

As to baling ;

“ The leak gains on our ship apace,
Here, ply the bucket ! bale who can ;
We need the work of every man,
Our sea-horse stands full to the breast.” ⁶

Like the ancient Greeks Northmen shifted quickly from ship to shore ;

“ All down the stream with unmanned prow,
Floats many an empty long-ship now.
Ship after ship, shout after shout,
Tell that King Hakon can’t hold out.
The bowmen ply their bows of elm,
The red swords flash o’er broken helm ;
King Hakon’s men rush to the strand
Out of their ships up through the land.” ⁷

⁶ V 3 pp 239, 137. The baling was by scoops ; *austker* they were called. In large vessels men who scooped up the bilge-water passed to others standing higher. Pumps were not used by Norse ships before about 1100 ; see p 17 Nicolaysen The Viking-Ship Disc at Gokstad : see below p 399 as to this book.

⁷ V 3 p 286. The *unmanned prow* means the men had left their station for battle.

Some long-ships meet a high-sided round-ship and attack her;

“The axes of the Northmen bold
A door into the huge ship’s hold
Hewed through her high and curved side,
As snug beneath her bulge they lie.
Their spears bring down the astonished foe,
Who cannot see from whence the blow.”⁸

There are touches of softness in the sagas though to those of our day habits of the times seem ferocious; King Magnus Barefoot who reigned 1093–1103 is said to have composed the following verses to his love Matilda daughter of the Emperor Henry IV;

“The ring of arms where blue sword gleams,
The battle shout, the eagle’s scream,
The joy of war, no more can please;
Matilda is far o’er the seas.
My sword may break, my shield be cleft,
Of land or life I may be reft,
Yet I could sleep but for one care,—
One, o’er the seas, with light-brown hair.
What sweetens brightens eases life?
’Tis a sweet-smiling lovely wife.
My time seems long in Thing affairs,
In Things my loved one ne’er appears.”

Upon receiving a message from Matilda,

“The lover hears:—across the sea,
A favoring word was breathed to me.
The lovely one with light-brown hair
May trust her thoughts to senseless air.
Her thoughts will find like thoughts in me;
And though my love I cannot see,
Affection’s thoughts fly in the wind,
And meet each other true and kind.”⁹

Laing is as interesting as the sagas; in his introduction he says,¹
“The ordinary way with the vikings of victualling their ships was to drive

⁸ V 3 p 255.

⁹ V 3 p 140.

¹ V 1 p 244 note.

cattle down to the strand and there kill them; xx it was expressed in one word *strandhug*." In the saga of another King Magnus the Good the following occurs;²

"But yesterday with heavy stones
We crushed their skulls and broke their bones
And thinned their ranks; and now today
Up through their land we've ta'en our way
And driven their cattle to the shore
And filled our ships with food in store."

But this way of provisioning failed no doubt at times, and men lived principally on un-cooked food such as cheese dried fish biscuit and the like, for only rarely could a fire be lighted in a long-ship. There is in the sagas no trace of cooking in long-ships though round-ships in their longer voyages had fires. Long-ships may often have been short of water; in a saga written about 1000 regarding a fleet which puts to sea in haste we read; ³

"No drink but the salt sea
Onboard our ships had we,
When following our King
Onboard our ships we spring.
Hard work on the salt sea,
Off Scania's coast had we."

At almost any opening the Heimskringla is interesting. When King Olaf the Saint entered the Thames about 1020 he rowed to London Bridge fastened cables to the supports and rowed away full speed until the cables brought up suddenly thus loosening the supports; a saga says, ⁴

"London bridge is broken down,
Gold is won and bright renown.
Shields resounding
War-horns sounding
Hildur shouting in the din!
Arrows singing
Mail-coats ringing
Odin makes our Olaf win."

² V 2 p 390.

³ V 2 p 395.

⁴ V 2 p 10.

A fleet is caught in a storm; ⁵

“Thou able Chief! with thy fearless crew
Thou meetest with skill and courage true
The wild sea’s wrath
On thy ocean path.

Though waves mast-high were breaking round
Thou findest the middle of Norway’s ground.
With helm in hand
On Saelo’s strand.”

Of narrowly technical things there are plenty. The crews embarked and disembarked readily; but we may not conclude the vessels were all small, though some carried probably not more than 20 or 30 men. In the case of a landing from a fleet of Olaf the Saint occurs mention of stone heaps laid under the ends of gangways from the ships to shore.⁶ This must mean that pier-heads were built out into the water and the end of landing gangways laid on these. In another place,⁷ we find horses onboard ships;

“Wet to the skin
We’re sound within
And gaily o’er the waves are dancing,
Our sea-steeds o’er the waves high prancing!
And now our ship so gay and grand,
Glides past the green and lovely land;
And at the isle
Moors for a while.

Our horse’s hoofs now leave hasty print;
We ride—of ease there’s scanty stint—
In heat and haste
O’er Gotland’s waste.”

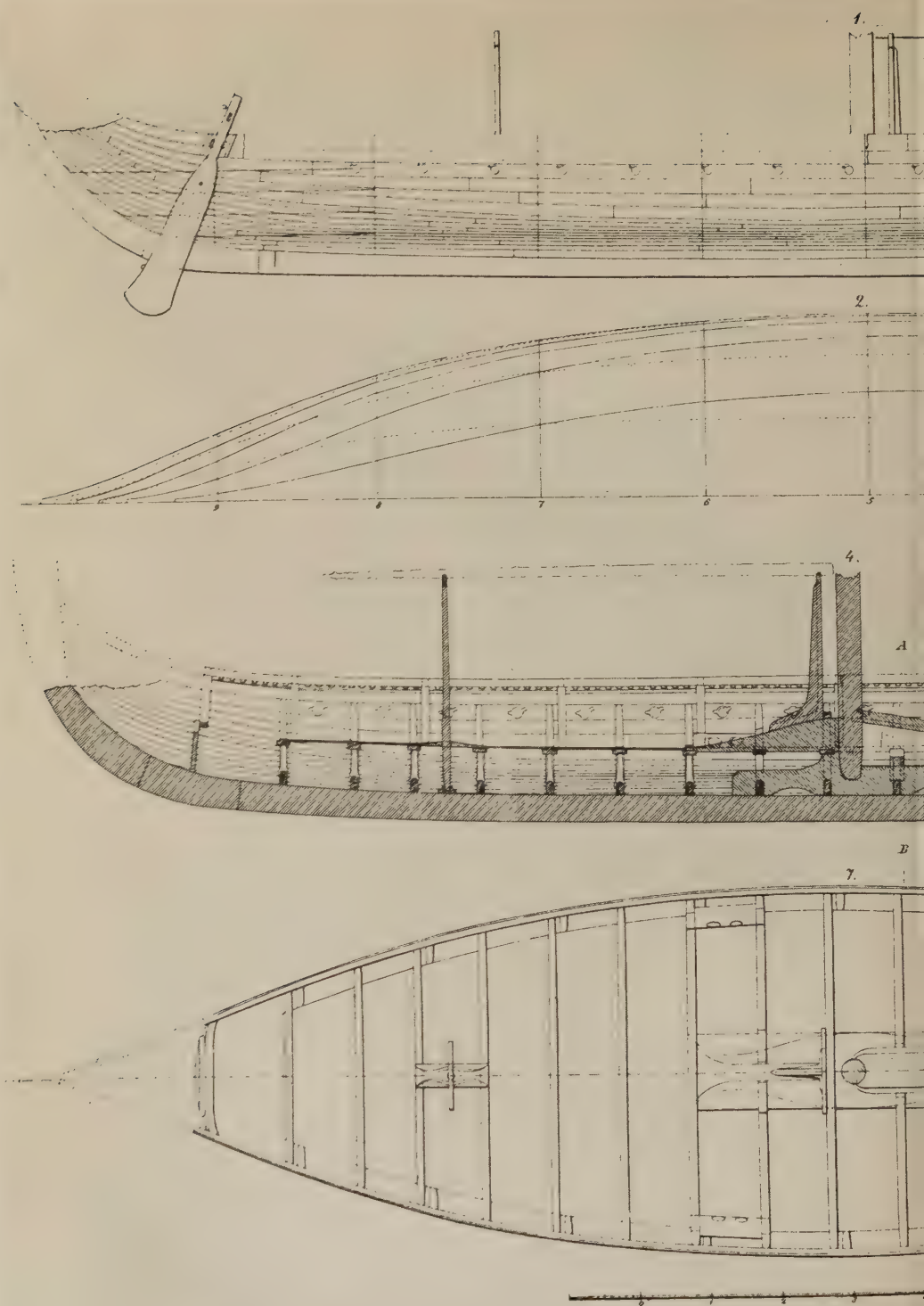
There is an illuminating statement about long-ships and how provided and maintained in Laing’s Introduction:⁸ in war-expeditions there were he says 2 round-ships, burden-ships carrying stores troops and provisions, for every 10 long-ships: the ship Long Serpent was 111 feet on the keel:

⁵ V 2 p 22.

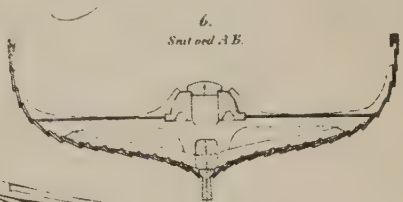
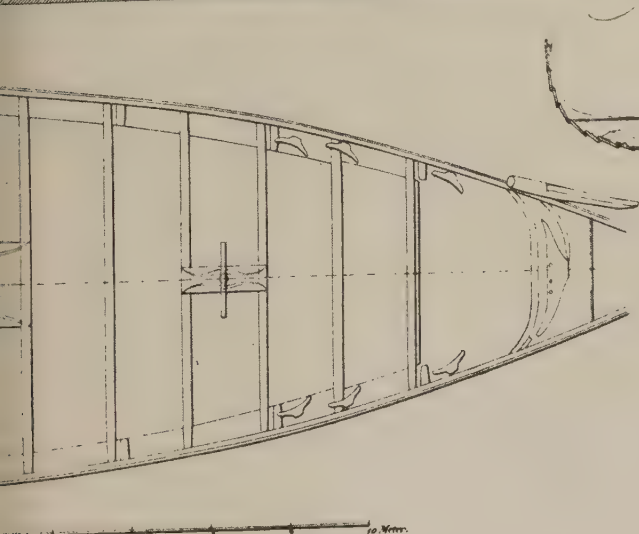
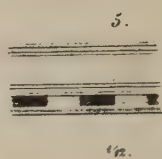
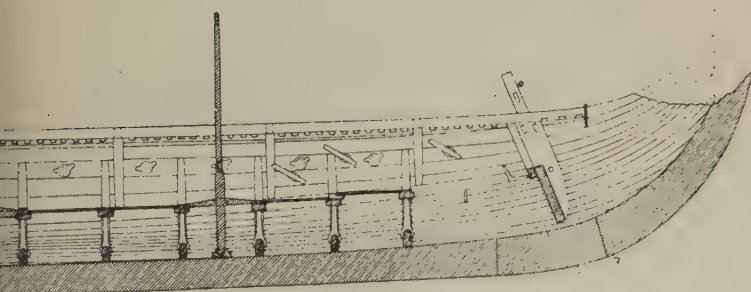
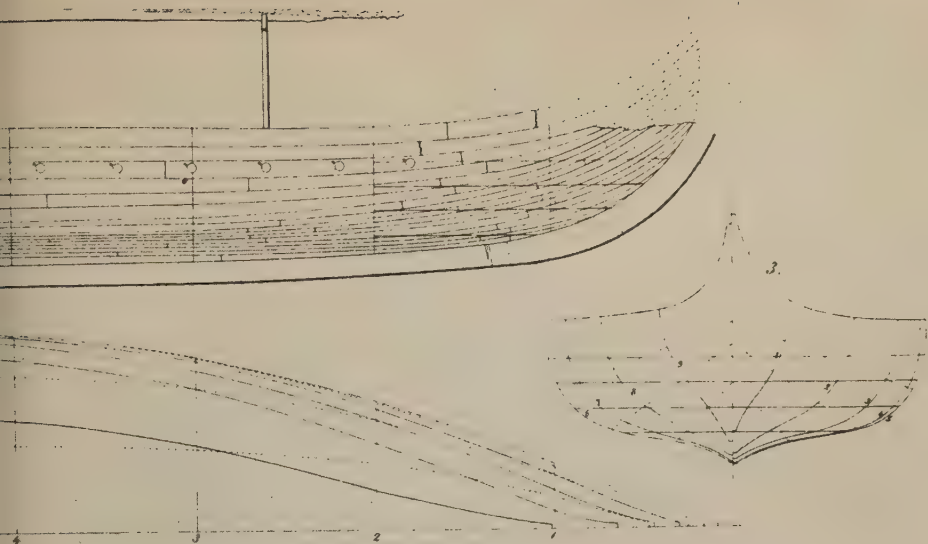
⁶ V 2 p 4.

⁷ P 72 v 2.

⁸ Pp 1-187 v 1. See above p 385 for war-fleets in which there were 7 round-ships to 10 long-ships.



This is plate 1 in Nicolaysen's Viking Ship from Gokstad. Fig. 1 shows the ship, its form and
See above page



other views are in figs. 2-7. A scale 11 meters in total length is at the bottom of the picture. vessel under sail.

stones and arms were stored under a deck of movable hatches on which men slept: a tilt covered the ship from end to end when the men did not go ashore and set up tents: the ships were like the large open vessels which today carry dried fish from the Lofoden Islands to Bergen⁹ which have a single mast 40 feet long without standing-rigging which is struck by the crew at times and only one sail. Except large ones ships were steered by an oar carried on a short beam projecting near the stern on the starboard side;¹ by the side of the steering-oar was a seat with a cushion; Kings often steered their own ships.

Norse vessels and ways were like Greek vessels and ways but ships of the North were far more sea-worthy than those of the Mediterranean. In them the vikings roamed far as the breeze can bear the billow foam. The Northmen's history from its most interesting side, that of the sea, has nowhere been as well told as by Laing in his *Heimskringla*. At almost any opening this tells of the ways of ships and sailors and the close resemblance to ways in the Mediterranean adds to interest of the story of both.² What might not a fleet of modern ships like the one Canute had about 1000 do; 1200 it numbered? It could carry 60000 fighting men besides 60000 composing the crews; if embarkation and disembarkation were as quick and sure as in Canute's day or that of ancient Greeks it could land these at day-break 300 miles from where they embarked at dark. But though the world were searched over could as many prime seamen as served Canute be found?

OLD NORSE SHIPS FOUND IN RECENT DAY.

In a book called *The Viking-Ship* from Gokstad is described a vessel found in 1880.³ She was carefully exhumed and everything found is described and pictured. She was a rowing and sailing craft, 66 feet long on the keel 17 feet broad and 4 feet deep from gunwale to kelson, pulled

⁹ This is full 600 miles in a wild sea. See above pp 274-5 as to ship named Long Serpent.

¹ Jal Glos Naut word *steor-bord* says, "The helm was suspended in Scandinavian vessels on the right hand. *Steor-bord* is the origin of the word starboard." As to the related word *stefn* Jal says, "It is probable that *stefn* meant both stem-piece and stern-piece in a ship, two timbers which must have been the same in the vessels of the Normans and Anglo-Saxons as the *rodes* of the vessels of the Middle Ages in the Mediterranean;" see Jal, words *rode* and *roda*.

² John Fiske in his *Disc America* v 1 p 154 says the *Heimskringla*, "Is one of the greatest history books in the world."

³ Nicolaysen Christiania 1882; Norse and English trans and illustrations: see picture here inserted and one at p 18 for completed vessel.

16 oars on each side and had probably one mast and one sail on this. The author Nicolaysen who superintended the excavating believes she had a crew of 70 men. The only unbroken oar is $17\frac{1}{2}$ feet long, but fragments found show there were some $19\frac{1}{4}$ feet long.⁴ The ports for the oars show well and are described as follows; ⁵ "As in the Bayeux Tapestries so in the Gokstad ship we find port-holes cut in its sides to receive the oars xx. These are set in the 3d plank from the top xx. The number on each side is 16 and their diameter gradually diminishes from amidships toward each end in proportion to the size of the oar fitted to each port." Each port as the pictures show consists of a round part large enough for the loom of the oar and a straight narrow slit long enough to pass the oar-blade through, and each has a shutter turning on a pin to cover the port when the oar is not in use. The author fixes the date at 850 A D and says she was built as a tomb for a man of consequence.⁶ Besides bones of men there were found some of horses and other animals. The part of the ship found entire is shown plate 1 Nicolaysen's work. She is clinker-built; that is her planks are laid on beginning at the keel and do not meet edge to edge but over-lap each other; her 2 ends are alike; she has a closed but not end-to-end deck about $11\frac{1}{2}$ feet above the kelson, and shipped her steering-oar on the starboard quarter.

The frontispiece of Nicolaysen's book shows a dragon-ship drawn according to the views of the author. She displays 32 shields alternately red and gold along the rail and therefore has 32 banks on each side and in all 192 oarsmen and 64 fighting men; a total crew of 256. She could not have been less than 170 feet long. Nicolaysen shows one mast with one square sail on the vessel. The yard has braces and the sail 2 bowlines at different heights of the leech. There are 2 lines of reef-points across the sail near its foot and Nicolaysen therefore believes the sail was reefed nearly in the way Columbus' sails were when the bonnets on their foot were taken off. As with Columbus' methods the question arises, when the sail was lessened on the foot was the yard lowered to bring the foot of the sail where it was before or left high so seas boarding the ship should go under

⁴ It is not likely these were pulled by less than 2 men. Serre says the battle-oar of the Greek triere the only oar used in battle when she had 3 men on it was $22\frac{1}{2}$ feet long; v 1 p 34 *Mar de Guerre*.

⁵ Pp 58-9 work cited: as to oar-ports which are below the gunwale of the vessel it is to be noticed there is no evidence of other line of oars either over the top of the gunwale or elsewhere. As to the ships of the Bayeux Tapestries see next p.

⁶ P 70. See also Nansen *Northern Mists* v 1 pp 110, 246-49.

the sail? ⁷ In this ship were fragments of 5 oaken bedsteads and a copper vessel for cooking.⁸ Possibly cooking was done only after landing for there was a law of Bergen of 1276 requiring that in harbor the crew be put ashore and brought back once each day and cooks 3 times, once to fetch water and twice to prepare food. As the code is commercial in character the rule applies to round-ships and not directly to long-ships.

A NORSE SHIP OF 1200 WITH OARS IN TWO LEVELS.

Nicolaysen says a saga states Erling Steinvaeg built in 1206 three ships much larger than any before constructed in Norway, which had the saga goes on,⁹ "What neither before nor since has been seen here 2 tiers of holes for the oars; the oars of the upper row were 30¾ feet long xx." In another work we find this, "Erling Skacke caused a boat to be built in the 12th century with 2 banks of oars one above the other."¹ The passages are near enough alike to confirm one another. While it is impossible the Greek texts mean oars in so-many rows, 8, 10, 20, 30, 40; it is impossible to believe oars were never at several levels; for above is authority for believing Norsemen arranged oars in stories, Leo the Wise says the Greeks did this about 900, Vinsauf says the Latins did the same about 1200; and we have the conclusions of 3 French naval officers that the Malays have done it in modern days.² The appearance in the Gokstad boat and those on the Bayeux Tapestries of oar-ports some feet below the rail goes to strengthen the case for storied oars and the statement of Admiral Serre that there are now French fishing-boats using oars in more than one level does the same.³

TWO MORE RECOVERED NORSE SHIPS.

The remains of a boat were found in 1863 near Nydam. She has been assigned to about 300 A D and is clinker-built, 75 feet long and 10½ feet beam; no masts or sails were found with her and her oars passed over the rail. Another was found near Tune also in Norway.⁴

⁷ In his description of this picture Nicolaysen says, "Representation of the ship under sail; height of stern and stem and form of pennant and sail conjectural."

⁸ Pp 42, 43, work cited. The men slept in a *hudfat* skin-bag.

⁹ P 29.

¹ Montelius Civ Sweden in *Heathen Times* p 182: cited also above p 85 n 6.

² Pp 379, 406, 82-6.

³ Above p 80 n 7.

⁴ See *Anc Vessel in Tune* trans Consul Gade and ded to Commander S B Luce U S N 1871.

OPERATIONS DURING THE CRUSADES.

The Crusades lasting from 1090 until 1291 brought to the Holy Land great numbers of persons and made it necessary to support them there. Toward the end of the period long-ships used sails more and oars less and masts and sails of round-ships began to look as in modern days; the oarsman is disappearing in over-sea operations for sailing-ships have become handy and capable enough to serve all needs. Operations against the Infidel began by sea before 1090 for by that date important places in the Mediterranean had been captured by Christian fleets. In 1147 a fleet from the North bound to the Holy Land being joined by ships of Portugal captured Lisbon from the Mahometans: ⁵ April 1190 a fleet carrying men arms horses and equipment sailed from Dartmouth England for the Holy Land and reached Syria before the capture of Acre June 1191, being about 14 months in making the passage. It went to Marseilles and stopped some time, passed a winter at Messina, remained at Cyprus long enough to over-run and capture it, and stopped at many other places;—perhaps for food water and recreation or perhaps idly. King Richard of England commanded the fleet, eminently a man of action but the habits of the day were leisurely. Our knowledge of the operations of this fleet is from the histories of Richard of Devizes and Geoffry de Vinsauf both English churchmen and both writing in Latin. The former joined the ships at Dartmouth and Vinsauf at Marseilles.

CHRONICLES OF DEVIZES AND VINSAUFA.

These are used below in whatever order seemed best: we read,⁶ “The King’s fleet having left its own shores sailed around Spain and from the Ocean entered the Mediterranean Sea which further on is called the Grecian Sea by the Straits of Africa and steered on to Marseilles there to await the King.” The King embarked at Marseilles; the King of France whose fleet was proceeding east at the same time joined it in Sicily: Devizes says, “The Frenchman being subject to sickness at sea marches by land to Sicily, the Englishman on the contrary about to proceed by sea comes to Marseilles to his ships.” Devizes gives no clue to how long the fleet was from Dartmouth to Marseilles but other records show it was about 90 days. The distance if the coast is followed is 1150 miles and across open sea from one head-land to the next 850.

⁵ Beazley *Henry the Nav* p 15: *Crusades Story of Nations* p 220.

⁶ P 11 *Chr Crus Richard Cœur de Lion* Devizes and Vinsauf Bohn 1848. See also Harris *Hist Roy Navy* v 1 p 77; Lindsay *Hist Merch Ship’g* v 1 p 375; above pp 282 and foll’g. The 2 chronos are in a single v continuously pagged.

Devizes goes on about sailing from Marseilles, "The ships which the King found ready prepared on the shore were 100 in number and 14 *busses*, vessels of great magnitude and admirable swiftness strong vessels and very sound, whereof this was the equipment and appointment; the first of the ships had 3 spare rudders 13 anchors 30 oars 2 sails 3 sets of ropes of all kinds, and besides these double whatever a ship can want except the mast and the ship's boat. There is appointed to the ship's command a most experienced steers-man, and 14 subordinate attendants picked for the service are assigned him. The ship is freighted with 40 horses of value⁷ trained to arms and with arms of all kinds for as many horsemen and 40 foot and 15 sailors, and with an entire year's provisions for as many men and horses. There was one appointment for all the ships but each of the busses received a double appointment and freight. The King's treasure which was very great and inestimable was divided amongst the ships and busses xx. All things being thus arranged the King himself with a small household and the chief men of his army with attendants having quitted the shore advanced before the fleet in galleys, and being daily entertained by the maritime towns taking along with them the larger ships and busses arrived prosperously at Messina.⁸ So great was the

⁷ These alone would now be worth \$12000: can it be the "experienced steersmen" were not provided with charts other necessary appliances and instruments available. Forty horses would occupy 800 square feet of deck space with deck above 6 feet; 35 feet length in a ship 24 feet beam: see below p 411 n 7. See Cordier's Yule's *M Polo* p 44 Introd v 1 for this song of Bertram de Born a troubadour of King Richard's day;

"I tell you a zest far before
Aught of slumber or drink or of food,
I snatch when the shouts of Alor
Ring from both sides; and *out of the wood*
Comes the neighing of steeds *dimly seen*."

Alor was the battle cry: see p 21 Ord Armadas Nav Aragon Ano 1354 Capmany 1787 for *los loores*, cheers, given on various occasions and other rules in Spanish government-ships.

⁸ Evidently the King landed often; the word ship means round-ship. These had 1 or 2 masts and probably one sail on each, could pull about 15 oars on each side; and thus enter or leave harbor in still weather, but perhaps they lay-to off ports. See below p 410 as to picture of a ship of 1200 with 2 masts and 1 sail on each. They had onboard 100 men 40 horses and one year's provisions; their displacement must have reached 250 tons. Devizes says the busses carried double; Jal says busses were large with considerable oar power. The galleys were long-ships, with great oar-power light and crank dangerous under sail and carrying little weight besides their men. The fleet made the run Marseilles to Messina 600 miles in 30 days going between Corsica and Sardinia; for Vinsauf p 162 says he went by land to Marseilles; "Where we stayed 3 weeks, then we embarked xx and passed between 2 islands, of which Sardinia one of them was on our right and Corsica the other on our left; here there is a great strait of the sea." See p 417 below for another description of a crusading fleet.

splendor of the approaching armament such the clashing and brilliancy of their arms so noble the sound of the trumpets and clarions that the city quaked and was greatly astounded and there came to meet the King a multitude of all ages xx." There is here an important datum; some ships arrived at Messina before the one our author was in and he found the men of these, "Stationed on the shore in pavilions and tents of different forms:" men lived ashore when considerable time in harbor. He writes also,⁹ "The prows of the galleys distinguished from each other by the variety of the paintings with shields glittering in the sun:" thus the Greeks distinguished ships and the Northmen hung shields on the rail.

Richard's fleet wintered at Messina when several land battles occurred, after which engines used in sieges on land are, "Taken down and stowed in the ship to take along." Devizes says in the spring,² "The fleet of Richard King of the English put out to sea and proceeded in this order: in the fore-front went 3 ships only, in one of which was the Queen of Sicily and the young damsel of Navarre³ probably still a virgin; in the other two a certain part of the King's treasure and arms, in each of the 3 sailors and provisions; in the 2d line there were what with ships and busses and galleys 13; in the 3d, 14; in the 4th, 20; in the 5th, 30; in the 6th, 40; in the 7th, 60; in the last the King himself followed by his galleys.⁴ There was between the ships and between their lines a certain space left by the sailors at such interval that from one line to another the sound of a trumpet, from one ship to another the human voice could be heard."

"Now as the ships were proceeding in the aforesaid manner some being before others 2 of the 3 first driven by the violence of the winds were broken on the rocks near the port of Cyprus;⁵ the 3d which was English more speedy than they having turned back into the deep escaped peril. Almost all the men of both ships got away to land many of whom the

⁹ P 164.

² P 37.

³ The Princess Berengaria daughter of the King of Navarre, married to King Richard at Limozen in Cyprus shortly after May 1191: she survived the King who died of a wound from a cross-bow 1199. The wedding is recounted p 190 Vinsauf.

⁴ Devizes says p 22, "In the fleet there were 156 ships 24 busses and 39 galleys, the sum of the vessels 219:" his statements agree. Only by this last one is the number of galleys or long-ships given.

⁵ The fleet was in the open sea: from Messina to Crete is 480 miles with no land in sight except possibly Island of Cythera off south of Greece; from Crete to Cyprus is 450 miles with no land in sight except possibly Karpathos S W of Rhodes.

hostile Cypriotes slew xx. The 3d ship in which were the women having cast out its anchors rode at sea and watched all things to report to the King. xx The next line of the King's ships came up after the other and they all stopped at the first. A full report reached the King who sending heralds to the Lord of the Island and obtaining no satisfaction commanded his entire army to arm from the first even to the last, and to get out of the great ships into the galleys and boats and follow him to the shore. What he commanded was immediately performed; they came in arms to the port." ⁶

"The King being armed *leaped first from his galley* and gave the first blow in the war xxx. The Cypriotes are vanquished the city taken with the castle besides xx." The Lord of the Island swears allegiance to Richard but shortly violates his oath and Richard again makes war, "The walls are cast down by engines hurling huge stones: the Prince of the Pirates being thus taken the King traversed the whole land xx. And because Lent had already passed and the lawful time of contract come he caused Berengaria daughter of the King of Navarre whom his mother had brought to him in Lent to be affianced to him in the island." The depth of water into which the King leaped armed from his galley must have been about 5 feet. Neither Devizes nor Vinsauf say how deep it was but Villehardouin ⁷ in his account of the assault on Constantinople 14 years later says as the galleys took the ground, "The Knights leaped in the sea to their sword-belts all armed." If this means a shoulder-belt, the water was about 5 feet deep.

To go on with the narrative: "After these things having taken again to the ships whilst sailing prosperously toward Acre he falls in with a merchant-ship of immense dimensions destined by Saladin to the besieged laden with provisions and full of armed soldiers xx. The intrepid King rejoices xx, having summoned to him the galleys of his followers the naval action with the Turk commences. The ship was fortified with towers and bulwarks. The assault was dreadful and the defence

⁶ Devizes says there were 80 men in each of 156 ships and 160 in each of 24 busses; which makes 16320 men to change over. I cannot recall another such case; possibly each ship and buss towed a boat at sea for Devizes mentions a ship's boat: this would make 180 boats; and if the water was smooth and they were large each might carry 50 men, a total of 9000. The 39 galleys could go successively alongside the 180 ships and busses and take off the remaining 7000 men; more than 150 men for each galley. There must have been prime seamen in the vessels.

⁷ Below p 419.

stout xx. The followers of Mahomet are vanquished; that ship the queen of ships is shattered and sunk as lead in the mighty waters. The King proceeded then to the siege of Acre xx; on the 3d day he caused his wooden fortress made in Sicily to be built and set up and before dawn of the fourth day the machine stood erect by the walls of Acre and looked down upon the city lying beneath it. There were thereon by sunrise archers casting missiles without intermission. Engines also for casting stones placed in convenient positions battered the walls with frequent volleys. Sappers made a way beneath the ground while soldiers bearing shields planted ladders and sought an entrance over the ramparts." The city was captured.

Many will look for mention of the compass in the writings of Devizes and Vinsauf for at this date it is written of ⁸ and we might expect to hear of them in ships. This will not be found however; neither is it in the work of Villehardouin of a few years later nor in the history of the Crusade of St. Louis of France 50 years after Richard's Crusade: in the last is mention of a chart in a ship and in use there.⁹

Vinsauf says of the siege of Acre before the arrival of Richard's fleet,¹ "Fifty ships such as are commonly called *coggs* having 12000 armed men are seen approaching xx. Oh happy fleet which sailing from the Northern Ocean passed over so many seas so many coasts and came from Europe along the shore of Africa to succor Asia in her distress. The men of these ships were Danes and Frisians. xx They had sailed from their country and the kindly breeze had wafted them on xx."

VINSAUF DESCRIBES SHIPS ROWED BY OARS IN MORE THAN ONE LEVEL.

Vinsauf makes important statements about arrangement of oars; he wrote about 1200 and as he came from Marseilles to the Holy Land in Richard's fleet was an eye-witness of what he describes. After telling of a sea-fight off Acre he writes,² "Now that mention is made of a sea-fight we judge it right to describe briefly the fleet and what difference there is

⁸ Above pp 263 and foll'g.

⁹ Below pp 410 and foll'g for Villehardouin; p 428 for St. Louis.

¹ P 105: Jal says coggs were round-ships; the word has many variants and survives in the French word *coque* the hull of a ship. It will be noted the 50 are large vessels having 240 men besides the crew.

² Pp 114-5: the words given below, "Oars at a longer others at a shorter distance from the sea" seem irreconcilable with zenzile rowing which was used in Venice at the time; see above p 77. See Jal Arch Nav v 1 p 237 for comment on Vinsauf's words.

between those of the moderns and ancients. With the ancients a large number of oars was required in ships of this kind which were arranged in stories, so that *some* plied the oars at a *longer* others at a *shorter distance from the sea*. These vessels had frequently 3 or 4 banks of oars each some even 5 and a few of the ships used at the Battle of Actium between Antony and Augustus are said to have had 6. xx The ships used at Actium were chiefly built at Liburnia in Dalmatia whence it became usual among the ancients to call them *liburnæ*. But all that ancient magnificence has passed away for ships of war which once had 6 banks have now seldom more than 2. What the ancients called a *liburna* we call a *galea* with the middle syllable lengthened; it is long and graceful not high out of water and has a piece of wood at the prow commonly called the spur with which the enemy's ships are struck and pierced. *Galleons* are vessels with one bank of oars manageable from their shortness easily turned and light for running to and fro, they are better suited for throwing fire." ³

"When they went forth to fight our men drew not up their ships in a straight line but in the form of a crescent that if the enemy should charge the inner ships he might be shut in and crushed. They placed their most powerful ships at the points of the crescent as against them would be directed the enemy's most vigorous attack. On the *upper row of benches* were arranged the shields close together, and in one the rowers sat in order that these who *were on deck* might have free *space for fighting* xx. As they closed the trumpets sounded xx and the battle is commenced by the throwing of missiles. Our men implore the divine assistance and ply their oars strenuously and dash at the enemy's ship with their beaks. The oars become entangled and they fight hand to hand having grappled each other's ships together and they fire the decks with burning oil which is vulgarly called Greek Fire: that kind of fire with a detestable stench and livid flames consumes both flint and steel; it cannot be extinguished by water but is subdued by the sprinkling of sand and put out by pouring vinegar on it. But what can be more dreadful than a fight at sea xx. One galley unskillfully managed by our men exposed its flank and being set on

³ Jal says galleons were mixed vessels, shorter than long- and longer than round-ships using both oars and sails; large ones had 3 masts and were propelled almost entirely by sails small ones used oars more. The mention by Vinsauf of throwing fire should be noted; it must mean by a machine not by a projecting substance; he often uses the term Greek Fire but it was to him only a violent burner not a projector of itself or other things.

fire received the enemy as they boarded on all sides. Another ship was boarded by the enemy who had driven the combatants from the upper deck while those who were below strove to escape by the help of their oars. Wondrous and terrible was the conflict, for the oars being pulled different ways the galley was drawn first one way then the other xx; our men prevailed, and the enemy, who rowed on the upper deck, being overcome and thrust down by the Christians, yielded xx."

This must mean the enemy having gained the upper deck manned the oars there and began to row, while the oars below, from which the Christians had not been driven, were rowed in the opposite direction. Vinsauf wrote in Latin and perhaps what he said might be rendered clear by joint labors of a Latin scholar and a seaman. The passage as a whole is the most complete description we have of ancient or mediæval rowing. It remains however difficult to conceive 20, 30, 40 lines of oars, as mentioned or to reconcile Vinsauf's words with the showing of Admiral Fincati that Venetian rowing in this period was *zenzile*.⁴

OTHER TECHNICAL POINTS IN VINSAUF.

Vinsauf alludes to a machine, "Able to cast stones of immense weight the blows of which nothing could withstand for it cast stones of incredible size to a great distance and it destroyed everything it struck. When the stones met with no obstacle they were driven into the ground a foot deep."⁵ Greek Fire is mentioned often but only as a substance which burns violently.⁶ As to the great Saracen ship met after leaving Cyprus Vinsauf says,⁷ "The King called Peter de Barres commander of one of his galleys and ordered him to row quickly and inquire who commanded the vessel xx. The King began to wonder at its immense size and compact make for it was crowned with 3 tall masts and it was well furnished in all

⁴ Above p 77. Vinsauf's words, "On the upper row of benches xx and in one the rowers sat in order that those who were on deck might have free space for fighting" may mean the lower tier of oars only was manned for battle and upper oars laid in to give clear deck for fighting.

⁵ P 126. This consisted of a beam swung by a weight and carrying a sling at the other end in which a projectile was placed. The highest point of the trajectory of a stone that would sink a foot into the ground could not be less than 100 to 150 feet. This is the only statement I know of which indicates the velocity with which these machines threw: the velocity indicated is about 100 feet per second; not in excess of that of a thrown stone.

⁶ Pp 130, 131, 197, 206, 211, and others.

⁷ P 197: Devizes' notice of this is p 405 above.

manner of equipments so that nothing could exceed them and it was abundantly supplied with all kinds of provisions. xx They had onboard a large quantity of Greek Fire in bottles and 200 most deadly serpents for the destruction of the Christians. xx The King ordered the ship to be attacked forthwith; after casting a shower of darts against each other xx our galleys rowed repeatedly round the ship but could find no point of attack it appeared so solid and so compact and of such strong materials xx. Our men plunged eagerly into the water under the ship's side and bound the rudder with ropes to turn and retard its progress and some catching hold of ropes leaped onboard the vessel. xx The enemy cut them to pieces but our men drove them back as far as the prow of the vessel while from the interior others rushed upon our men xx. The battle lasted a long time and many fell xx and the enemy forced our men from the ship. The King xx then commanded that each of the galleys should attack the ship with its spur that is its iron beak. Then the galleys drawing back were borne by the rapid strokes of the oar against the ship's sides to pierce them and thus the vessel was instantly broken and began xx to sink."

Vinsauf recounts as to firing on walls of Acre by throwing-machines of swinging-beam variety that King Richard,⁸ "Built one covered with raw hide and ropes not to be destroyed by any blows nor open to injury from pouring Greek Fire thereon. He also prepared 2 mangonels⁹ one of which was of such violence and rapidity that what it hurled reached the inner rows of the city market place. These were plied night and day and a stone from one of them killed 12 men with one blow xx. King Richard was not yet fully recovered from his illness but xx made arrangements to assault the city. For this purpose he caused to be made a hurdle put together firmly with complication of interweaving xx intended to be used for crossing over the trench into the city. Under it he placed his most experienced arbalesters and he caused himself to be carried there on a silken bed and from it by using his arbalest in which he was skilled he slew many with darts and arrows. His sappers also carried a mine under the tower and

⁸ P 206.

⁹ The word *mangonel* was used in the M Ages in various forms; see above p 383 and n 5 there. As with classes of ships the names of throwing-machines have been numerous but there were never more than 2 principal classes; great cross-bows projecting at high velocity and small angles and beams swung in vertical plane by weights or men pulling ropes, projecting heavy bodies or burners contained in easily broken receptacles at low velocity and large angles. The former were nearly useless against walls of towns and the latter when fired from ships at other ships.

xx filled it with logs of wood and set them on fire, when xx the tower fell suddenly to the ground with a crash.”¹

A CRUSADING FLEET CAPTURES CONSTANTINOPLE IN 1204.

Fourteen years after Richard's fleet sailed from England for the Holy Land a band of Crusaders prepared to go thither turned aside to storm capture and loot Constantinople, the richest and most refined and splendid city in Europe. She saved Christendom from the Saracens 500 years before and if not despoiled and brought low might have withstood the Turks in 1453 and saved southeastern Europe and the site on the Bosphorus, the fairest and best in the world, from the blight of Turkish rule. The perpetrators were actuated by commercial rivalry and a wish to put themselves in funds. The Venetians who furnished the ships desired to destroy their commercial rival and to aid the Crusaders from various parts of Europe who were in the ships to rob enough to pay the costs of the expedition.² Though the world suffered by the despoiling of Constantinople the circumstance gave rise to an important book written or dictated by Joffrois de Vile-Hardoin, le mareschaus de Champagne as he calls himself, one of the first books written in a Romance tongue.³ Before coming to the story 2 pictures in the edition of Wailly must be noted. They are stated by the editor to be taken from a manuscript of 1200 the time of the expedition.⁴ One shows a ship with 2 masts and 1 sail on each, the sails being triangular with one side bent to a yard at the mast-head while the apex opposite is drawn down to the deck by a sheet; the sail has only one sheet. Such sails are shown in the ships of Wm the Conqueror

¹ This explains mining in days when there were no explosives: a tunnel was dug under a wall or tower and shored up with wood; when ready to assault the wood was set fire to and its support failing the superincumbent structure fell. The *arbalest* was a *cross-bow*; *arbalette* in modern French. The same word was sometimes used to mean a cross-staff for measuring angles. P 616 Conq Constantinople Villehardouin reviewed just below men firing cross-bows in about 1200 are pictured: King Richard died of a wound from one April 1199; they must have been very common by 1200 but I recall no mention at earlier date. Large standing cross-bows were in use by 400 B C. So it was with gunpowder guns; large bore heavy guns—guns-of-position we call them—were used before man-carried guns.

² See Pear's Fall of Constantinople; Ville-Hardouin cited next note; Cousin Hist de Const 8 vs v 5 pp 382–445 Hist des Empereurs xx. The story of one of these emperors was written by Nicetas who was in the city during the assault and sack; Ville-Hardouin was outside.

³ Geoffroi de Ville-Hardouin Conquete de Constantinople Wailly 2d ed Paris 1874; original and trans into mod French are given. There is an Eng trans by T Smith.

⁴ Pp XVIII and 616 Wailly ed.

100 years earlier.⁵ An oar for steering shows on the starboard quarter, the other side of the ship does not show. Men are in the ships but the picture is much out of proportion for the ship's length is barely twice the men's height; a man is going aloft by a rope. The other picture shows men with cross-bows firing on a tower.

Hardouin was a French soldier and his book is much esteemed. The old French is not hard to read and there is parallel translation into modern French. Hardouin accompanied the expedition from Venice where it took ship and was present throughout. With others he was sent to Venice in advance to arrange for transportation of the Crusaders when they should arrive and reached the city March 1201. In Venice he and those with him placed their business before the Doge; the envoys say to the Doge,⁶ "Sire we are come to thee on the part of the great barons of France who have taken the Sign of the Cross xx to reconquer Jerusalem if God will suffer this. And as no people have so great power to aid this as you they pray you to have pity on the Holy Land beyond-sea xx and that you will do all possible to supply vessels-of-transport and of war." The Doge after some days tells the envoys, "We will prepare *huissiers*⁷ to carry 4500 horses and 9000 esquires and in the *nefs*⁸ 4500 knights and 20000 men-at-arms not mounted: for the horses and these people the ships shall carry provisions for 9 months. We will do at least this on the condition we shall be paid 4 marks for each horse and 2 for each man,⁹ and these conventions we will adhere to for one year after sailing from Venice to do the work of God and Christianity in whatever place may be. The sum of the expense is 85000 marcs. And here is what we will do further; we will add 50 armed galleys¹ for the love of God on the condition that

⁵ See p 86 n 2 for these; and p 427 below as to pictures of Crusading ships of Louis of France, 1248.

⁶ Pp 9-23 Wailly.

⁷ *Vuissiers* in Hardouin's French. The word comes from the French *huis* a door: they had a door in the stern partly below the water by which horses entered and left; to the opening a bridge could be adjusted and doors were fitted in the sides of vessels. Horse-transports were sometimes called *palanders*. *Huissiers* must have been usually 9 or 10 feet from keel to upper deck and 24 feet beam to carry 2 lines of horses placed athwartships: a ship carrying 40 horses which King Richard's vessels carried (above p 403) would have a length of about 120 feet: the Doge thus promised 113 *huissiers*.

⁸ In Hardouin's text this is *nes*. The word has several English meanings; round-ship burden-ship vessel-of-transport sailing-ship.

⁹ A mark was 20 to 25 of our pennies. The passage money for a man from Venice to the Holy Land was 50 pennies and for a horse one dollar: this could not have included food.

¹ Villehardouin writes *galees armées*.

as long as our conventions last of all conquests that we make in land or wealth by sea or land we shall have one-half and you the other half. Consult among yourselves and see if you can agree to these conventions." What follows is of interest as showing the habits and views of the day but too long and little connected with matters of the sea to be inserted. Expressions of religious devoutness are interspersed with those regarding commercial gain in ways not usual in modern days, and some will believe the Venetians grasping and hypocritical but the motives of modern deliberations of this character are not free from hypocrisy and greed.

It remains to say a word about the fleet. The horses and esquires, 4500 of the first and 9000 of the last, with a part of the food and water these would require in 9 months, were to go in 113 huissiers; vessels 120 feet long 24 feet beam and 8 to 10 feet from deck to keelson. The knights whose horses were in the huissiers, 4500 in number, and 20000 armed men, 24500 in all, were to go in nefs, and were to have 9 months' provisions and water for considerable time. If there were 200 fighting men in each nef,² making with the crew a total of say 225, we may assume these were of about 250 tons and 125 in number. The ships totalled then 113 huissiers 125 nefs and the 50 fighting ships; the last offered by the Venetians without charge; 288 sail in all. Onboard the 238 huissiers and nefs were not less than 5000 seamen some of them pilots of renown: for the rental of the ships, services of seamen to manage them, and food for 4500 horses and 33500 men for 9 months the Venetians asked 85000 marks; some \$21000 in our money. It was certainly planned to make the enterprise self-supporting.

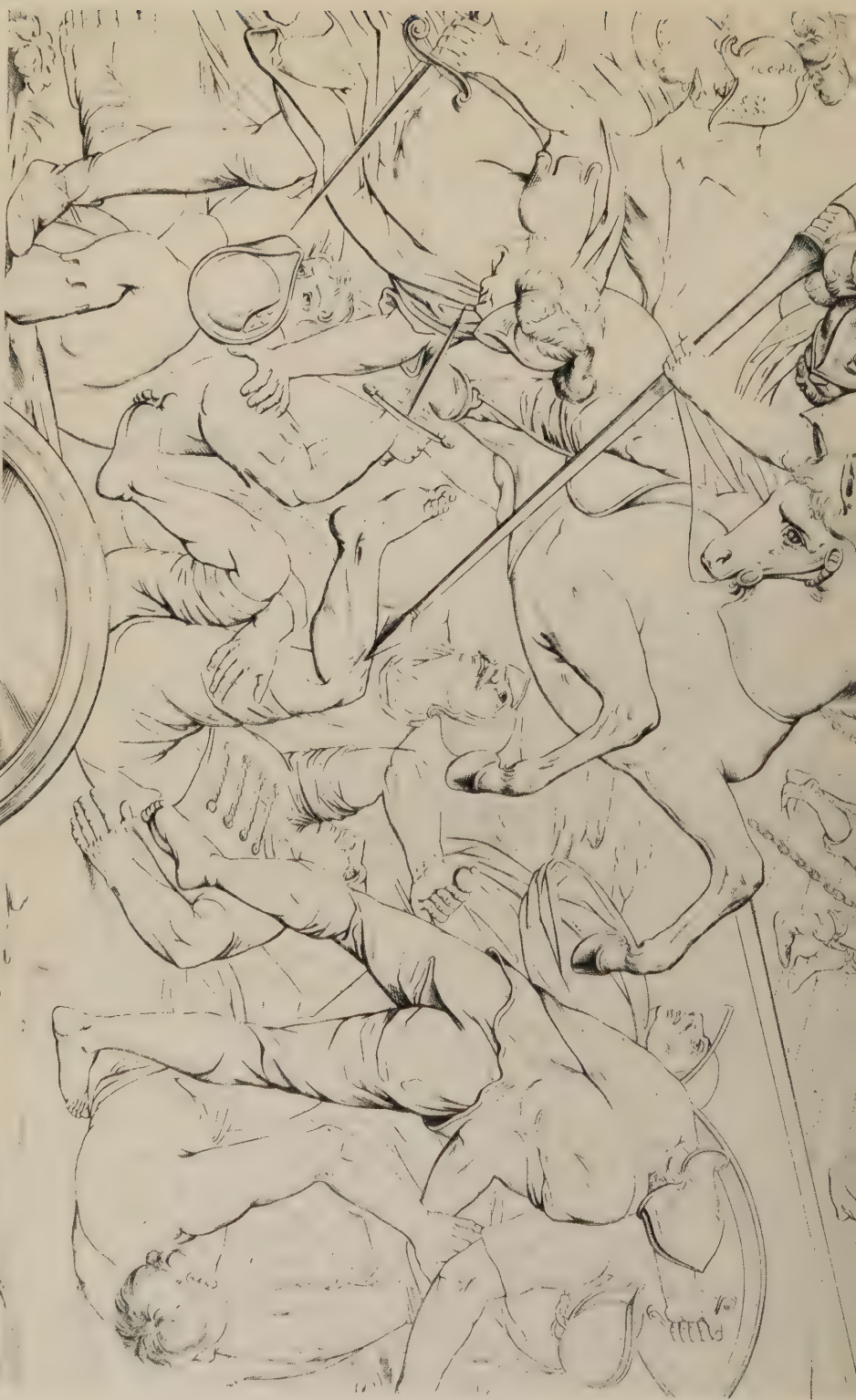
Ville-Hardouin ends his narration of the negotiations at Venice with the words, "We were now in Lent and in a year, on St John's day 1202, the pilgrims were to be at Venice and the ships ready to receive them."³ Hardouin then mounted his horse and returned home meeting several leaders of the Crusade and recounting the arrangements made: they were full of joy and said, "We are already on the march and when you come you will find us ready."

"After Easter towards Pentecost the pilgrims began to leave their homes," Ville-Hardouin writes,⁴ "They rode by the way of Burgundy by

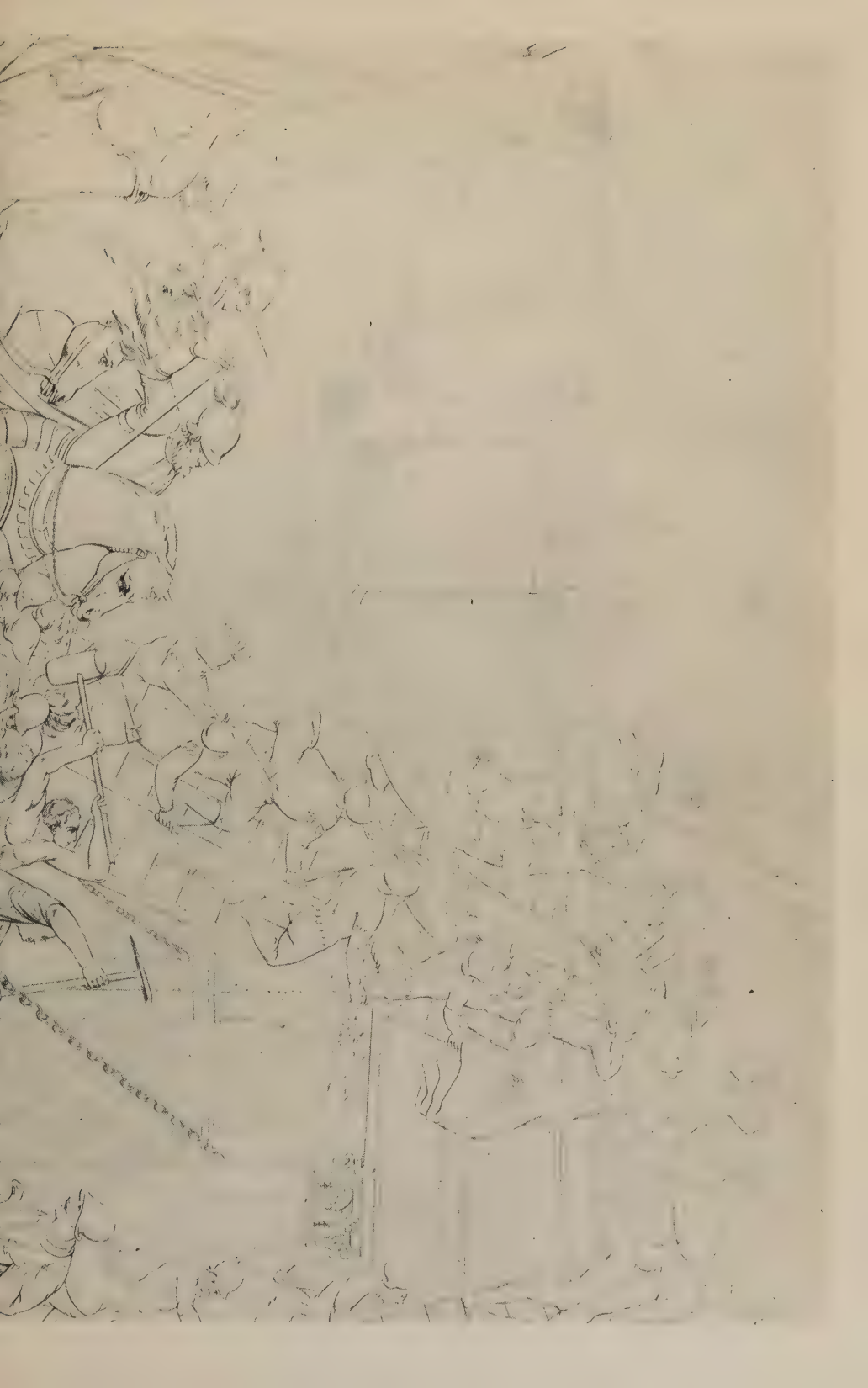
² King Richard's had 100 men 40 horses and 1 year's provisions; see p 403 above.

³ The conventions were concluded March 1201 and ships were to be ready and pilgrims in Venice by June 1202.

⁴ P 29; it was June 1202.



This is pl 140 v 3 Zamotto's Palazzo Ducale. The text describes it, "Assault by land and sea on Zara by Crusaders under the Doge Enrico Dandolo in 1202, painted by Andrea Vicentino." Vicentino was 300 years later. Ships appear to the left and above.



the Mont Cenis by Lombardy by xx and began to assemble at Venice where they were lodged in an island called St Nicholas in the port. At this time sailed a fleet by sea from Flanders and it carried great number of good men armed. Of this fleet Jean de Nele chatelain of Bruges and xx were the chiefs.⁵ And they promised Count Baldwin and swore on relics that they would go by the Strait of Marocco and would join the army of Venice and him wherever they learned he had gone xx. It was beautiful and rich this fleet ⁶ and the Count of Flanders and the pilgrims had much hope in it for the larger part of the men-at-arms were in it. But they kept their word to their lord badly, fearing the peril into which those at Venice entered. We shall not say more of these but of the pilgrims adready arrived at Venice. Count Baldwin was there and many others and there came to them news that many had gone by other roads and to other ports. This troubled them greatly for they could not carry out their agreement nor pay the money they owed the Venetians. Thus the army going by way of Venice was much decreased in numbers while the fleet prepared was the richest and most beautiful in nefs huissiers and galleys that ever Christian man had seen; large enough for 3 times the men in the army. The Venetians had kept their word and more, they summoned the counts and barons to keep theirs and pay the money they owed for the fleet was ready to sail."

"The leaders made attempts to raise money and the Doge addressed his own people as follows,⁷ 'My lords these people cannot pay more xx. Let us make an agreement with them. The King of Hungary took Zara ⁸ from us one of the strongest cities in the world, never with all the power we have can we recover it except with the help of these people. Let us ask them to aid us in conquering it and we will forgive the 34000 marks of silver they owe us until God permits us to regain them together, they and we.' On a Sunday the people of Venice and barons and pilgrims assembled in the Church of St Mark and before the Mass the Doge Enrico Dandolo mounted the reading-desk and spoke, 'My lords you are associated with the best people in the world and in the greatest affair ever undertaken. I am old and feeble have need of repose and am crippled but I see none of you

⁵ Not seamen but knights.

⁶ For fleet Hardouin has *estoire*: Jal says it is a corruption of *storum* or *stolium* which Middle Age authors use for a fleet.

⁷ P 37.

⁸ Called Jadres in Sclavonia by Hardouin. Pl 140 v 3 Palazzo Ducale Zanotto here inserted shows attack by sea and land on Zara.

know how to govern and command as I do. If you will permit me to take the Sign of the Cross to guide and direct you and will allow my son to remain in my place and guard the country I will go and live or die with you and the pilgrims.' The people cried with a loud voice, 'We pray God you will do as you say and come with us.' Great was then the pity of the people of the land and the pilgrims and many were the tears shed, for this good man had reason to rest for he was an old man xx and had lost his sight by a disease of the head.⁹ xx He descended from the reading-desk went before the altar and falling on his knees wept sorely and they sewed on his breast a great cross for he wished the people to see it. Then the Venetians began in great numbers and multitudes to take the cross, in those days there were still few who had taken the cross. Thus the Doge took the cross as I have told you. Then they began to give the nefs galeres and huissiers to the barons for our departure. And now listen to one of the greatest marvels and great adventures you ever heard of."

Then is given an appeal of Alexis of the imperial family of Constantinople. His father had been deposed and blinded and Alexis wishing to gain the throne told the Crusaders, "If you will help me I will do everything you tell me to do."

Hardouin goes on as to the capture of Zara on the coast of the Adriatic which had been resolved on, "Then were divided the nefs and the huissiers by the barons. Ah! how many good chargers were loaded into the huissiers! And when the nefs were loaded with arms food knights and sergeants the shields were ranged all around the sides and castles of the nefs and the banners also of which there were so many and so beautiful. And you must know that the nefs carried *pierriers* and *mangoneaux*¹ as many as 300 and more, and all engines used to take cities in great numbers. Never a better fleet left port; it was the octaves of the feast of St Remi² in the year of the Incarnation 1202 they departed from the port of Venice as you have heard. Upon the eve of St Martin³ they came to Zara xx and when the pilgrims saw the city they said to one another, 'How can such a city be taken unless God himself takes it.' The first

⁹ Some say Dandolo was blinded by order of the Emperor when sent to Constantinople as ambassador some years before, and sought revenge.

¹ Hardouin pp 474-81: also above p 409 n 9; below p 421 for statement of mounting and using both these in ships. The engines stated to have been carried by ships may have been to land, not to fire from ships.

² Oct 8.

³ Nov 10.

nefs that came to the city anchored and awaited the others. In the morning it being beautiful weather and a clear day all the galleys arrived and the huissiers and the nefes that were behind; then they took the port breaking the chain which was very strong and well arranged and disembarked, the port being between them and the city. Then you might have seen many a knight and many a sergeant leave the nefes and take from the huissiers many a good charger many rich tents and many pavilions. So the army encamped and Zara was invested St Martin's Day."⁴

The people of Zara sent heralds to the Doge and pour-parleys followed in the course of which the Abbe of Vaux exclaims, "My Lords I forbid you in the name of the Pope of Rome to attack this city, for its people are Christians and you are pilgrims:" but, "In the morning they approached the gates of the city set up the pierriers mangoneaux and other engines of which they had many: on the side of the sea they set up ladders on the nefes."⁵ The machines began to fire on the walls and towers. This lasted 5 hours, and then the sappers began to sap a tower. When those in the city saw that they asked for terms. Thus the city was surrendered to the mercy of the Doge the lives of the citizens being saved. Then the Doge said to the counts and barons, 'My Lords, we have conquered the city by the grace of God and your assistance. The winter has come and we cannot go forward until Easter for we can find no supplies elsewhere and this city is rich and well-furnished. Let us divide it in two, we will take one half and you the other.' As it was said so it was done. The Venetians had the part nearest the port where the nefes were and the French the other part. All the best houses were given to each as convenient and the army broke camp and came to live in the city. Three days after they were lodged in the city a great misfortune happened for the Venetians and French began a fight great and ferocious and everyone ran to arms. Few were the streets where men were not fighting with sword and spear cross-bows and darts, many were wounded and killed. But the Venetians could not keep it up and began to lose many and the leading-men entered into the fight all armed and separated the combatants. When separated in one place they began in another. Much damage was done to both sides."

During the winter of 1202-3 the army and sailors lived in the city; many deserted and there was little unity in councils held. Some seized ships and made off and others went by land; the army was diminishing

⁴ Nov 11, 1202.

⁵ The water was bold.

every day but news came of the missing fleet of Flanders: "The fleet of Flanders," Hardouin writes,⁶ "Of which I have spoken had arrived at Marseilles. xx They were ordered to winter there and after consulting with the Doge and the barons they were ordered to sail in the month of March for the port of Modon. Alas! They acted very wrongly and never kept their promises for they went to Syria where they knew they could accomplish nothing." Also during this winter messengers were sent to the Pope to pray for absolution for taking Zara: this was done the messengers were to say because necessary to keep the army together. The Pope absolved them, "And commanded them with prayer to hold the army together for well he knew that without this army the service of God could not be performed." As the fleet quits Zara Alexis pleads with the Crusaders to restore his house at Constantinople. He promises,⁷ "If God grants that you give me back my heritage I will bring my Empire into obedience to the See of Rome from which it has long been separated. I know you have spent all the treasure you have and are poor, I will give you 200000 silver marks and food for the whole army and will go with you on the Crusade in person and will come if you believe it will be best so with 10000 men at my own expense. I will continue this service for 1 year and as long as I live will maintain 500 Knights in the Holy Land to guard it."

This was favorably received by the fleet and priests, for there were many churchmen in the force. Some however opposed an attack on Constantinople because the city was Christian and Ville-Hardouin gives the words of a number regarding this. The fleet left Zara April 1203 and touching at Dyrrachium came to Corfu. Many pilgrims lodged in the principal city of the island, others, "Pitched tents and pavilions and took the horses from the huissiers to refresh them." They remained 3 weeks in Corfu during which further evidence of want of discipline is shown; "A large part of those who wished to disperse who had before shown contrariety held conference saying the affair seemed long and perilous; they would remain in the island and let the army go on."

The army thus loses more men. Then the voyage is resumed, "They went onboard the nefs and put the horses in the huissiers and sailed from Corfu the eve of Pentecost 1203 of the Incarnation.⁸ All the nefs and huissiers and galleys were assembled and a number of nefs belonging to

⁶ P 59; it was 6 months from Flanders to Marseilles.

⁷ P 53.

⁸ May 24, 1203. The words quoted are p 69 Wailly.

private merchants were in company. The day was beautiful and clear and the wind soft and fair when the sails were spread to the wind. And Joffrois li mareschaus de Champaigne who dictates this history who never has lied in a word to his knowledge and was at all the councils tells you that never so fair a sight was seen. It seems as if this fleet might conquer the world for as far as the eye could see only the sails of nef's and other vessels could be seen so that the heart was lifted up. They ran thus to Cademelée⁹ at a strait in the sea. They met here 2 nef's with pilgrims knights and squires onboard returning from Syria. xx Count Baldwin of Flanders sent the *barge de sa nef*¹ to learn who they were. A squire of one of these nef's slid down from his vessel into the barge exclaiming, 'I am going with these men for I believe they go to conquer the earth.' The fleet sailed on to Nigre. Nigre is a large island with a considerable city called Nigrepont.² Here the barons held a council. xx The knights armed and went ashore and the people of the country xx gave them so much that they made peace with them. Then they returned to their vessels and resumed the voyage xx. The ships ascended the Hellespont to a city called Abydos, a beautiful and well situated city. They entered the port and landed and those of the city came to meet them and delivered over the city, not daring to defend it. So good a guard was maintained that they of the city lost not a denier. They stayed here 8 days awaiting the nef's huissiers and galleys which had not joined. During this time they took the corn on the shore; it was the harvest season and they needed it greatly not having any. In 8 days all the vessels and barons arrived, God had given them favorable weather."

"The fleet left Abydos all together. The Hellespont³ above us was covered with nef's and huissiers and galleys. xx They came the eve of St John the Baptist in June to St Etienne an abbey 3 leagues from Constantinople. Then all could plainly see Constantinople. They entered port and anchored. You may believe that those who had never seen the city regarded it much; they could not believe there could be in the world so rich a city when they saw its high walls and rich towers built close and

⁹ Catamata at the south end of Greece 150 m from Corfu.

¹ These are the words of Villehardouin: it was the nef's boat either habitually towed or hoisted.

² The island is north of Athens; 100 miles from the last stop. That the squire slid to the boat shows the nef was high-sided.

³ Called Bras de St George, Abydos is called Avie. From the narrative it seems the row-ships go ahead and nef's and huissiers follow as wind serves.

round its rich palaces and lofty churches of which there were so many that no-one who has not seen them can believe, and the length and width of the city which among all others is sovereign. And you must know that no man was so hardy but that he shuddered and no wonder for never so great an affair was before undertaken since the beginning of the world."

"The counts and barons and the Doge of Venice landed and held council in the church of St Etienne:" the Doge tells the council if the men are allowed to land on the mainland for food many will stray off and be lost to the army: "There are islands near by that you can see," he goes on, "Their inhabitants produce corn and food and other things needed. Let us go to these and collect the harvest and other food and when we have done this let us go before the city and do what Our Lord may decide. Surely those who have had food to eat fight better than those who have had none." The counts and barons then returned to their ships and our author continues,⁴ "The morning of the feast-day of St John the Baptist in June the pennants and banners of the Church were unfurled on the castles of the nefs the covers taken from the shields and the *bulwarks of the nefs set up*. Each examined his arms knowing surely he would soon need them. The sailors raised the anchors set the sails to the wind and God gave them the wind they needed. We passed thus in front of Constantinople so close to the walls and towers that the *nefs fired* on them many times for there were men on the walls and towers but appeared to be none anywhere else. Thus God Our Lord made them change their plan of the evening before to go to the islands as though each one had not heard it spoken of. The ships came to the anchorage in front of the palace of the Emperor Alexis at a place called Chalcedonia; it is opposite Constantinople on the other side of the Bosphorus⁵ towards Turkey. This palace is one of the most beautiful and delicious places that eyes have ever beheld with all the delicate things that a man can desire who may live there like a prince. The counts and barons now landed and lodged in the palace and in the city near-by; many had their pavilions. The horses were taken from the huisiers and the knights and squires landed with their arms, so that only the seamen remained in the vessels. The country was beautiful and rich and planted with grain and the corn which was harvested at the grinding mills, so as much as each needed he took as having great want xx."

⁴ P 75: the date is 1203.

⁵ He calls the Bosphorus the Bras the name he calls the Hellespont. It is here said the nefs fired on the enemy but not certain they fired standing-machines.

“ The day was decided when they should embark in the vessels to land in force to live or die and know that this was one of the most momentous things ever done. The bishops and clergy showed the people they must confess and draw up their wills, for they did not know what was God’s will concerning them. This all the army did willingly and piously. xx The knights were all onboard the huissiers with their chargers, all armed helmets laced and the horses saddled and covered. The people not needed at the battle were onboard the great nefs ⁶ and the galleys were all armed and prepared. It was a beautiful morning; ⁷ a little after sunrise xx the trumpets sounded and each galley had a huissier in tow to approach more quickly. They did not ask who should go first but each went as quickly as possible. The knights left the huissiers, each *leaping all armed into the sea up to his sword-belt* helmet laced and lance in hand; the good bow-men and good squires and good cross-bowmen landed, each with his own company. When the lances were lowered the Greeks fled leaving the shore. Never was a port more splendidly captured. Then the mariners began to open the doors in the huissiers and to launch the bridges and to take the horses out. The knights mounted their horses and formed line of battle. xx Then was taken the Castle of Galata, and the Port of Constantinople won by force of arms. xx The next day the nefs galleys and huissiers were brought into the Port and then was council held to decide if the city should be attacked by sea and land. The Venetians wished to raise ladders in the nefs and that the only assault should be by sea. The French said they did not understand the affairs of the sea xx. Thus it was decided the Venetians should attack from the sea and the French from the land xx. The peril and labor of the attack lasted 10 days for on a Thursday morning ⁸ the assault was prepared and their ladders also and the Venetians also xx. The Doge of Venice xx ordered his nefs huissiers and all vessels to form in one line and the line was 3 cross-bow shots long; then they began to approach the shore under the walls and towers. Then you might see mangonels throwing over the nefs and huissiers ⁹ and the

⁶ In Hardouin’s text *granz nés*. The horses are ready but do not land until after their riders, see just below.

⁷ July 17, 1203.

⁸ July 17, 1203. This is p 97. The horses are saddled onboard the knights leap into water shoulder deep and afterwards sailors land the horses by the doors and over bridges.

⁹ The mangonels were swinging-beams throwing heavy stones. Arbaletes were man-carried cross-bows. The length of the line of ships 3 cross-bow shots must have been as much as 1000 yards: there is nothing to show the number of ships.

flying bolts of the arbaletes and the bows discharging great numbers of arrows and those within defending themselves as best they could. The ladders of the nefs approached so near that in several places swords and lances were engaged with the enemy¹ and the tumult was so great it seemed the earth and the sea might be swallowed up. And know that the galleys did not dare to touch the land.²"

"Now you must know a deed of prowess. The Doge of Venice was an old man and could not see at all; he was armed and at the bow of his galley and had the sacred banner of St Mark before him. He cried to his men to land and this they did, for as the galley took the ground they leaped out of her and carried the sacred banner of St Mark before the Doge. When the Venetians saw the banner of St Mark ashore and that the galley of their Lord had taken the ground before theirs they all leaped ashore; those in the huissiers jump out and wade ashore and those in the great nefs enter barges and go ashore as quickly as each can.³ Then you might have seen a great and marvellous assault to which testifies Geoffroi de Ville-Hardouin the Marshall of Champagne who made this work; it is more than 40 persons told him that in truth they saw the sacred gonfalon of St Mark on one of the towers and that they could not tell who bore it there."

This attack was in July 1203 and August 1 Alexis, the claimant to the throne who was with the fleet, was crowned Emperor. He paid the money promised, but quarrels and disputes arose and during street-fighting the city was nearly destroyed by fire. This was followed by open war and the Greeks filled 17 nefs with combustibles and turned them adrift when the wind was right, but the Venetians grappled the burning hulks and hauled them clear. Revolutions in the city follow and a certain Murzuphle makes himself emperor but is unable to stop the disorder.

¹ See picture p 422 below.

² Hardouin's words are, *Et sachiez que les galies n'osoient terre prendre*. They did not fear running them on the bottom for in the text just below it is stated this was done: they feared because when galleys grounded in 4 or 5 feet the enemy would wade out to attack them. In the text just below it is narrated how men landed: as the galleys took the ground they, "All leaped ashore, those in the huissiers jump out and wade ashore and those in the great nefs enter barges and go ashore as quickly as each can." The 3 classes of ships were when they grounded and the men leave them in say 4, 7, 10 feet of water.

³ The words great nefs are in the original *granz nés*: as to ship's boats see above p 417 and note next above.

The Crusaders now prepare to fight,⁴ "They *set up the mangonels and pierriers on the nefs and huissiers and all the engines for assaulting a city* and placed at the mast-heads and yards ladders so high they were a marvel. When the Greeks saw this xx they put 2 and 3 wooden floors on the towers to further raise them; never was a city so well fortified. Those in the camp consulted xx with the result that if God let them enter the city by force all the gain taken should be brought together and divided equally, and if they were masters of the city 6 French and 6 Venetians should be appointed to elect an emperor. And he who was chosen emperor should have a quarter of all the conquest in the city and without it and besides the Palaces of Bouchelion and Blaquerne; the 3 other quarters should be divided in 2 parts, one-half for the Venetians and the other half for the camp. Then should be taken 12 of the wisest of the camp of the pilgrims and 12 of the Venetians and they should divide the fiefs and honors among the men. This convention was sworn to by the French and the Venetians. xx Thursday after Mid Lent⁵ they entered the nefs and led the horses into the huissiers. xx The next day the nefs and galleys and other vessels approached the city and began the assault. In many places the men landed and advanced to the walls and in many places the ladders set up in the nefs were so near that those on them fought with sword and lance with those on the walls and towers hand to hand. The assault lasted rude and strong and proud until after noon and in more than 100 places. But because of our sins we were repulsed."

"The army and the Doge held a council xx and resolved that on Monday⁶ they would attack, binding the nefs carrying the ladders 2 and 2. Two nefs would then attack a tower xx and as it was said so it was done. On Monday the nefs and huissiers armed and the assault began proud and marvellous. It lasted long until Our Lord raised a wind called Boire; this forced the nefs and other vessels further on the beach than before and 2 nefs one called Pelerine and the other Parois approached a tower so close one on one side and the other on the other as God directed and the wind that the ladder of the Pelerine touched the tower. Instantly a Venetian and a French knight entered the tower and others after them while those of the tower fled. xx Soon 4 towers were taken. Then those in the nefs

⁴ P 135: this statement that mangonels pierriers and engines were *set up in the ships* is the clearest case of this I can recall: the former were great cross-bows and the engines for assaulting, swinging-beams: all mounted in the ships.

⁵ Apr 8, 1204.

⁶ Apr 12.

huissiers and galleys began to attack and breaking in 3 gates entered the city x x; they began to take the horses from the huissiers and the knights mounted and rode to the palace of the Emperor. The army lodged that night in Constantinople and the city was taken Monday of Easter." ⁷

Villehardouin says all booty was brought to one place without disorder to be divided as arranged, "As for thefts," he adds, "A good many were hung for this. x x You may easily believe the booty was immense; for not counting all that was stolen and the part of the Venetians it amounted to 400000 silver marks and 10000 saddle-horses. The gain of Constantinople was divided as you have heard." An election for emperor was held and Baldwin Count of Flanders chosen. His principal opponent was Boniface Marquis of Montferrat and all feared he might use his power against any other chosen emperor; but he came to Baldwin in the church and, "Rendered him all honor possible."

To be appreciated Villehardouin must be read and his own words spelled in the manner of the day are easy to follow. There is no writing so interesting and picturesque showing the habits of the time and manner of making war. The great armada was supported and held together by the wit of its commanders; the War Office in Venice had to do with the original muster and fitting but once the fleet sailed it was cut off to be maintained by what in our day would be called robbery and rapine. Yet one feels it may have been a pleasant time to live.

WHAT NICETAS WHO WAS IN CONSTANTINOPLE SAYS OF THE SIEGE
AND CAPTURE.

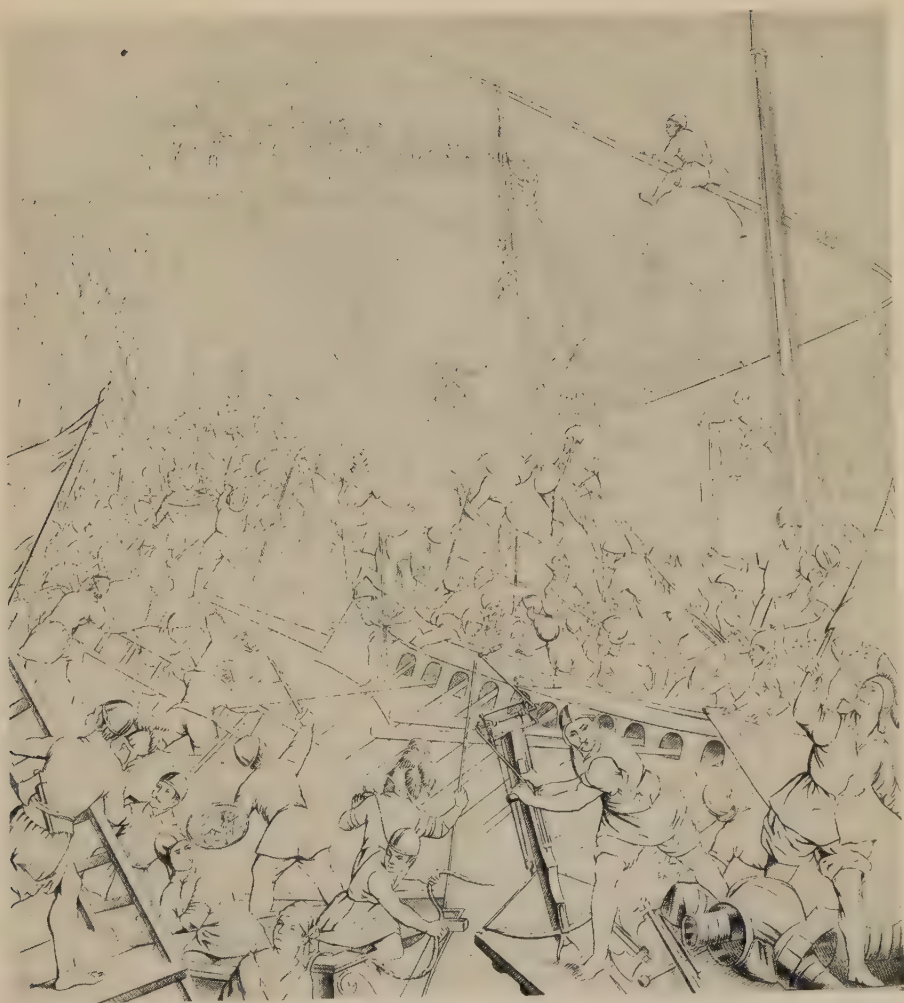
It has been mentioned that Nicetas was in Constantinople during these times and that his account has been preserved.⁸ He tells of ships carrying ladders on the masts from which the ships being grounded men assailed those on the city walls, of throwing-machines hurling great missiles over the walls among the houses and people, and of the fall and sack of the city; "The mistress of the orthodox religion the home of the sciences" he laments. Following Nicetas' history of the siege in his *Histoire de l'Empereur Baudouin*.⁹ Among the weapons used in the defense of Constantinople we expect to find Greek Fire since it was used many centuries earlier,¹ but neither Villehardouin nor Nicetas mention

⁷ Apr 12, 1204: see picture here inserted.

⁸ Cousin Hist de Constantinople v 5 pp 385-6.

⁹ Work cited note next above v 5 pp 403-27.

¹ Above p 376.



This is pl 144 v 3 Zanotto's Palazzo Ducale. The text describes it, "Second attack of Constantinople by Crusaders under Enrico Dandolo in 1204, painted by Domenico Robusti called Tintoretto." Tintoretto was about 300 years after. The numerous towers of the city's walls show above: men reach the top of these by ladders and masts and yards of ships. The rowing is scaloccio, which it was in Tintoretto's day but perhaps not in that of the battle: the fighting men have the upper deck to themselves, the rowers being covered by this. The portable cross-bow with ratchet to cock it should be noted. The nefs drew too much water to come to the walls but show to the right.

it in the siege. Nicetas is clear about it on other occasions saying the Emperor's ships consumed those of the enemy with Greek Fire, and in another place, "They threw upon the houses of the unfortunates Greek Fire to consume them."² There is a rendering of this by Lalanne as follows,³ "They threw on the houses of the unfortunates living near the sea fire contained in *closed pots which bursting suddenly with sharp flashes burnt all objects it reached.*"

EXPLOSIVE SHELLS IN THE YEAR ABOUT 1200.

The substance in the closed pots was explosive. The passage is a description of what we call shell-fire; the projectiles were thrown—necessarily by mechanical guns—from ships and the year is about 1200, for our writer Nicetas died in 1216. This is probably the earliest date for explosive shell. Pictures of projectiles with flame issuing are not uncommon in dates shortly after, which projectiles while they may have continued merely to flame from a hole on falling near the enemy may have been arranged to burst then. Present day percussion shell contain a fuze of which the plunger is released from a fastener by the bump when the shell is ejected from the gun; *armed* it is called, and the fuze remains in armed and dangerous state during the projectile's flight. When the projectile strikes the plunger jolts against an ordinary perfussion cap thereby lighting the explosive in the shell. The shells Nicetas writes of were perhaps arranged like the flaming shells old pictures show and perhaps when these fell the jolt communicated the flame to the explosive in the shell: bursting suddenly with sharp flashes and burning neighboring objects would follow. The flaming shell was dangerous from the moment the gunner lighted it; our way, consisting in screwing a little metal fuze-case containing necessary parts into the shell, harmless until the bump in the gun occurs, is safer to those who handle it.

This refers to the use of explosive shell in high-angle fire only; that from mortars and short guns at low velocity. It is only in the past 75 years that ship-guns all high-power and low-angle have used explosive shells; though earlier attention had been drawn to the destruction they wrought on ships. Until 75 years ago explosive shells were little used in low-angle high-power guns, though such guns had

² Pp 256, 264, v cited note 2d preceding.

³ Feu Gregeois p 22: the Greek is given with French trans: see p 446 below as to explosive shell at later date.

been used 400 years and explosive shell 500. In the naval wars of the Period of Sails, 1500 to 1850, explosive shells played no part: it is strange they did not, for it was not because of want of anything material.

THE LATIN EMPIRE OF CONSTANTINOPLE.

Baldwin, first of the Latin Emperors, was crowned May 1204; the line lasted only till 1261 when the former line regained the throne. With political events we have no concern, but it should be noted from the first our ships had no regular leader nor source whence money and supplies could be drawn. The blind Doge is a striking figure but an usurper of power, not a commissioned leader; he died in Constantinople shortly after the city was taken. The office of Doge of Venice was no sinecure; many commanded fleets and armies and not a few were killed. The age was verging on the days of the *condottieri*, fighting-men who made war to gain a livelihood, selling their services to any prince who wished to war with a neighbor and arranging rules so that the game might not be deadly. The men in this fleet lived by such industry and while some were killed or injured their lives were full of excitement and interesting adventure. Armies when going far went by ship as is now the case and fighting on-shore was the soldiers' business and that at sea the sailors'. In former days however more persons were seamen than now, for those at sea lived on the upper deck while a life-time might now be spent at sea almost without seeing a wave. The business of seamen was to conduct the ships safely and expeditiously and as to this their views were consulted. It was not until about 1600 that formal separation between land and sea military forces became general.

In this crusading fleet were many churchmen but it does not appear they stood out against the assault of Constantinople. The Pope sent word as has been mentioned he hoped the army could be kept together, and would no doubt have been glad to have the Eastern Church brought into agreement with Rome. Perhaps when the fleet set up Alexis as Emperor he could have provided what was necessary to hold it together, but this was not done and the city was in continual disorder. Looking at events now they seem to have been controlled by a power higher than that of the leaders. We cannot defend spoiling the city, but the Crusaders did well in making Baldwin Emperor for he was a wise moderate and able man whose rule was accepted by all. Bloodshed and disorder come to an end and the fleet melted way, their promise to restore the Holy Places coming to

naught. After Baldwin was Emperor military operations on the sea occurred but there is no useful account of them nor of the return home of the men or ships. Hardouin says of some ships a little earlier,⁴ "There were in Constantinople 5 nefs loaded with pilgrims knights and squires, Venetian nefs very large and beautifully fitted, which went to their own land. And there were onboard these 5 nefs full 7000 armed men." They may have been carrying the men of the fleet home, for a ship bringing pilgrims from the Holy Land would not come to Constantinople. This makes 15 to 16 hundred armed men in each ship as well as the crew.

THE TWO CRUSADES OF ST LOUIS.

In August 1248 the first crusade of St Louis, Louis IX of France, sailed from Marseilles; the record runs,⁵ "It was in the month of August we embarked in our vessels at the Rock of Marseilles. The day we went onboard the doors in the ships were opened and the horses we were to take over-sea led onboard; then the doors were closed and well stopped as tight as a barrel because when a ship is at sea the door is under water. When the horses were in the master-seaman⁶ called to the seamen who were at the bow of the vessel saying to them, 'Are you ready?' They replied, 'Yes sir.' He said, 'Let the clerks and priests come forward.' As soon as they were come he called to them, 'Sing,' and they sung with one voice, 'Veni Creator Spiritus.' And the master cried to the sailors, 'Make sail in the name of God' and thus they did. The wind filled the sails and we lost sight of the land in a little time and saw only sky and water, the wind carrying us each day further from the land where we were born. And I can show you that he who has been guilty of mortal sin is foolishly bold who puts himself in such peril for when you go to sleep at night you do not know but in the morning you will find yourself at the bottom of the sea. In the sea a marvel came to us. We saw a round mountain on the coast of Barbarie, we sighted it at about the hour of vespers and navigated all the night and thought we had made more than 50 leagues.⁷ But in the morn-

⁴ P 233 Wailly ed: see *Jal Arch Nav* v 2 pp 149-51 as to this vessel; p 143 same v for another large ship; p 347 for still others.

⁵ Jean Sire de Joinville *Hist S Louis* Wailly Paris 1874: there is an English ed in Bohn another by Hutton and one in the original French by Michel. Wailly gives orig and modern French.

⁶ In the text of Joinville this is *maistre-notonnier*; in modern French *nautonier* is a sailor.

⁷ A report from the seamen; about 150 miles; the seamen must have believed the ship could make good runs.

ing we were still by the mountain and thus it was 2 times or 3 times. When the sailors saw this they were all astonished and said the vessel was in great peril for it was the land of the Saracens of Barbarie. A good priest called Dean of Maurupt told us there was never an affliction in his parish by want of water by too much rain or other cause but that as soon as 3 processions were made on 3 Saturdays God and His Mother provided deliverance. It was Saturday we made the first procession around the 2⁸ masts of the ship; I was supported by my arms for I was grievously sick. Never after saw we the mountain and we arrived at Cyprus the 3d Saturday."

The distance from Marseilles to the African coast is 450 miles and steering midway between Sardinia and the Balearics neither would be seen. From the point in the Barbary coast where the round mountain was probably seen to Cyprus is 1500 miles; Joinville says the ships made this in 21 days, 71 miles a day, a good day's-work for a fleet. He also says they thought they could make 50 leagues in the night but the mountain held them. This is too great a distance unless driven by a gale. The ships carried horses but we do not know how many; also, some ships had 2 masts. There is nothing as to how many were in the ships but we find this when the King returns to France; at which time on nearing Cyprus the King's ship grounded: "As soon as our nef struck," writes Joinville,⁹ "A great cry arose each crying Alas! And the seamen and others beat their hands together for they feared to be drowned x x. The seamen cried, 'Ho the galley save the King.' But of 4 galleys there none approached, in which they were wise for there were 800 persons in the nef who would all have jumped into the galley and thus sunk her." The men were to be taken from the nef by galleys, not by ship's boats. A galley could certainly carry 200 besides her complement; so the 4 galleys could have taken the 800 in the nef; this was possibly the reason 4 galleys were in company. That 800 were in the nef shows she was large.

The nef was saved in a way not explained and the King continued in her although divers reported a length of keel beaten off. As to the run home Joinville says,¹ "After we had been 10 weeks at sea we came to a port 2 leagues from a castle called Hyeres." It is impossible to say how

⁸ Note the number.

⁹ Pp 339-341, Wailly; in the same pp it is narrated the King returned in a fleet of 13 sail nefs and galeres and that the fleet ran from coast of Syria to Cyprus 300 miles in 5 or 6 days.

¹ P 359: Hyeres is near Marseilles.

far the ship came in 10 weeks. From the point she left in Syria to Marseilles is 1800 miles, from Cyprus to Marseilles 1500. Besides Cyprus 2 or 3 places are mentioned during the voyage and at some people landed but may have gone in galleys while the nefs lay off the harbor or continued the voyage, for galleys in very short runs in smooth sea were faster than nefs. As the King was in a nef most persons of importance were, and here they could live sleep and eat without landing if they wished.² On the page of our authority last cited there is a statement as follows,³ "In these Marseilles vessels there are 2 rudders attached to tillers so wonderfully that as quickly as one could turn a horse the vessel can be turned to the right or left. The King was sitting at one of the tillers of the rudders on Friday and calling me said xx." This must have been tillers and rudders much like ours; the King could not have been sitting down and steering a ship carrying 800 people—of perhaps 1000 tons displacement—by oars.

Reference may be made to an illustration in the edition of Joinville under review bearing the legend,⁴ "*Départ de S Louis pour la croisade*," taken the editor states from a manuscript of 1350 in the National Library in Paris. It shows the King in the middle of a ship with feet on her bottom, his waist is even with the rail making the vessel 3 feet from keel to rail: the diameter of the King's head is greater than the ship's freeboard: if the King lay down he would extend $\frac{3}{4}$ the ship's length and he with 7 other standing men completely fill her length. At the bow and stern are battlemented towers whose diameter is that of the King's head and height equal to his; in each 2 or 3 men armed with spears and lances are shown. The vessel has 2 masts each with one sail and one yard; the yard is at the mast-head and the sail is set not by a sheet but by wrapping its lower part—which is an angle, for the sail is a triangle, not 4-sided—loosely around the mast half way between the yard and the ship's rail. No way of steering shows.

Such are these pictures of ships. This one is comparable with those on the Bayeux Tapestries and Catalan Atlas, more grotesque than those

² See below p 428 n 7 as to an accident.

³ The word *rudders* is in Joinville *gouvernaus* which Wailly translates *gouvernails*: see *Jal Glossaire Naut* word *gouvernail* and pp 180-84 v 1 his *Arch Nav*. When hinged rudders became common is uncertain. Many vessels of the M Age were steered by oars but ships as large as that of *S Louis* could not have been. Herodotus tells of rudders driven through the keel (see above p 110 n a) and large ships must always have steered by hinged rudders. Yet the oldest picture I can remember of one is of 1325 A D: it will be found pp 399-402 v 1 *Lindsay Hist Merch Shipping*. See p 110 above.

⁴ P 453.

in the Boro-Boudour Temple, wholly inferior to those on the Greek Acropolis and thousands of years back of these again, on monuments in Egypt and Mesopotamia.⁵ Joinville says the ship of S Louis carried 800 souls; yet he is shown with 7 other men completely filling a ship. There are other pictures like this: one shows an Anglo-Saxon ship of about 700 A D in which are men of exaggerated size and another horse-vehicles of the same nation and date containing men of similarly exaggerated proportions.⁶ Perhaps others can explain why men were drawn so much larger than correct: for the same reason perhaps that in carvings in Egypt and Mesopotamia Kings are shown much larger.

THE SECOND CRUSADE OF ST LOUIS.

St Louis' second crusade set out in 1270 for Tunis and he died at Carthage not long after arriving out. Joinville our late historian did not go but there is a co-temporary history. In these times one looks for mention of astrolabes compasses and charts in ships but the first two are not named by Joinville or in the history now to be reviewed though we must believe they were in the ships. A chart is mentioned by this last author in use in the ship; the first explicit mention of this. The King took ship at Aigues-Mortes near Marseilles and our historian says,⁷ "In the Sea of Lyons was a tempest which for that is renowned for it is deep and always rough and full of waves x x. Saturday morning the sea was more pleasant and this day and Sunday they sailed in peace x x. Monday toward sundown many people and horses had died and all were uneasy and much astonished because it seemed to them they took too long a time to arrive at the port of Chastian Castre in Sardinia⁸ where the barons of the pilgrimage were to wait for each other. For this cause was the master called before the King who asked him how far it was from the point where they were to Chastian Castre. The master replied to the King and declared

⁵ Above pp 82 and foll'g and p 261 as to ships at Boro-Boudour.

⁶ Strutt Chron England 2 vs 1779 v 1 p 337. P 248 v 2 this work is a map now in the Cottonian Library identified by experts as of about 1000 A D; its legends are in Anglo-Saxon and Latin and while it is far from correct the person who drew it was trying to make a map, while those who drew the illustrations often reproduced as M Age maps were making handsome pictures of religious character. I do not think this map is elsewhere shown. The picture of an Anglo-Saxon ship of 700 A D will be found p 5 above.

⁷ Rec des Hist des Gaules et France v 20 Vie S Louis par Nangis pp 441-7; in co-temporary French untranslated. The Rec is in the N Y Public Library. P 389 same v is told S Louis' ship struck a shoal returning from Syria on his first crusade.

⁸ Cagliari, in the south of Sardinia 375 miles from Marseilles.

he believed they were close to land and many marvelled they were so long without seeing it. Then was the *mapemonde* brought before the King and he was shown the position of Chastian Castre and how near they were to it."

The words imply much: that reckoning was kept of courses and distances and position pricked on a chart good enough to serve seamen; all this being so much a matter of course as to carry conviction it was usual and universal. The run from Marseilles to Cagliari 375 miles was made in 7 days but there is little indication how the wind was. Some believe this writing marks the beginning of use of charts in ships. Neither Nangis Joinville Villehardouin Vinsauf Devizes nor the Norsemen's Sagas, all by men actually at sea in ships—and that prince of story-tellers Marco Polo as well—mention compasses astrolabes or the reckonings of ships; but we have description of compasses using lights at night 200 years before any of these men lived and know maps of large areas were made, and necessarily by ship's reckonings, many centuries earlier. Those who built the oldest buildings in the world and those who set up the dial of Ahaz 2000 years before the day of these writers were able to define direction, and distances were measured before a history book was written.

OTHER PASSAGES IN JOINVILLE.

Joinville writes of Greek Fire as a propellant as does Vinsauf whose day is a little earlier as well as Leo the Wise and Constantine Porphyrogenetus some 300 years before.¹ In regard to disembarkation at Damietta in Egypt he says,² "The King ordered x x to deliver a galley to me and to xx to enable us to disembark with our knights, for the great ships³ could not come to the land. x x I went x x to ask for my galley but x x said I could not have one. When my men saw we were to have no galley they slid down from the great vessel into her boat. x x. Then we started for the shore x x and landed in face of a great body of Turks where were 6000 horsemen. As soon as we came to the land they spurred their horses towards us. We fixed the points of our shields and the foot of our lances in the sand with the lance-points toward them when they fled. On our right landed the Count of Jaffa in noble style for his galley was all painted

¹ Above pp 379 and foll'g and below pp 435 and foll'g as to Leo and Const Porphyrog.

² Pp 85-95 Wailly.

³ Joinville has *granz neis*.

below and above water x x. He had full 300 rowers in his galley ⁴ x x and she seemed to fly under the impulse of the oars. The tymbals drums Saracen horns and pennants in the ship made so great a noise it seemed as if the thunder had fallen from the heavens. As soon as the galley reached as far up in the sand as they could drive her he and his knights all armed and with splendid equipments leaped from the galley and formed themselves near us. As soon as the Count of Jaffa was onshore his men pitched the tents and pavilions. When the Saracens saw this they spurred towards us but turned back when they saw we did not fly. To our right at the range of a great cross-bow landed the galley of x x. A Saracen when he saw the men land from her rode among them; whether he could not control his horse or thought the others would follow I know not but he was cut in pieces. The King when the flag of St Denis was landed not wishing to be separated from it leaped into the sea, he was in water up to his arm-pits. He went with his shield hung on his neck his helmet on his head and lance in hand and joined the others on the beach. The Saracens announced 3 times to the Sultan by *messenger-pigeons* the King was landed. The King sent to the Legate and all the prelates in the army requiring them to sing in a loud voice *Te Deum Laudamus*. The King then mounted his horse and we all did the same and we all went to lodge in Damietta. The King enquired of the barons clergy and laity how what had been taken in the city should be divided. The patriarch replied first saying, 'It seems to me best that you should yourself keep the cheese barley and rice and all other foods to provision the city, and that criers should proclaim in the city that all other movables of all kinds should be brought to the hotel of the Legate under pain of excommunication.' The barons all agreed with this. Now it resulted that all the movables thus brought to 'the hotel of the Legate come to only 6000 livres. When this was done Jean de Valery x x said, 'The customs of the Holy Land are when a city is taken of all found there the King takes a third and the pilgrims two-thirds.' "

There are 2 statements which help to fix the size of St Louis' warships; *galies* Joinville calls them: these are that the Count of Jaffa had 300 rowers and that the King had the sea up to his arm-pits when he

⁴ If rowing *zenzile*, 3 men in each group, there would be 6 men on a thwart across the vessel: to accommodate 6 men the beam must have been 20 feet and as 50 thwarts are required the length of the rowing space must have reached 150 feet. The vessel was about 200 over-all long and 22 feet beam: she drew 5 to 6 feet probably.

leaped on his ship grounding.⁵ It was stated just above that the galley of the Count of Jaffa was not less than 200 feet long and 22 beam. Such a craft would be 12 to 13 feet from gunwale to keel and would draw 5 to 6 feet. She had probably an end-to-end deck and was materially larger than the Persian ships which 28 centuries earlier brought the men who fought at Marathon. When these were defeated and turned to fly Herodotus says, "The Athenians hung on the runways x x chasing them all the way to the shore on reaching which they laid hold of the ships and called aloud for fire. It was in the struggle here that Callimachus x x having seized an enemy's ship by the *aplaston*⁶ had his hand cut off by the blow of an axe and so perished."⁷

The words indicate the fighting after Marathon was in water knee- or waist-deep, 3 feet say, but St Louis leaped into water 5 feet deep; and if his ship was twice as long and wide as the older ones and heavier in scientific proportion, she carried 6 or 7 times the weight those at Marathon carried. There is in Joinville another proof that war-ships had grown. While the army was near Damietta much distressed by the Saracens and disease it was ordered the sick should be loaded into galleys and carried away: Joinville writes,⁸ "The seamen had made great fires to receive the sick in their galleys and the sick were brought to the river's bank." The ancient ships did not light fires onboard.

TRANSPORTATION OF HORSES: POWERFUL MAN-CARRIED CROSS-BOWS.

In the landing whose circumstances are just above nothing is said of how horses were put onshore though the men mounted after landing: they must have been thrust through the doors to onshore. There is the following account of how they were stowed onboard,⁹ "There were 105 galleys in the fleet. The smaller were of 2 and 3 ranks of rowers of which 8 were fitted to carry 300 horses. The others had one rank only. When they were equipped the horses and provisions were loaded x x." This fleet was equipped at Constantinople and the meaning must be that vessels

⁵ Joinville's word for arm-pits is *esseles*: *aisselles* in modern French: when a Knight couched lance Joinville writes he put it *desous s'essele*.

⁶ The turned-up scroll-work at the ship's *stern* (note the ships lie at the shore with stern landward). The scroll had marks distinguishing ships. The Northmen used similar marks. In the Middle Ages in the Mediterranean the word became *aplustre*.

⁷ See above p 119.

⁸ P 167. The season was early spring.

⁹ Cousin Hist Constantinople v 7 p 233.

rating 2 or 3 ranks of rowers carried 35 horses each, which standing athwart-ships in 2 rows would call for athwart-ship dimension of 25 feet and fore-and-aft about 60. The horses alone would weigh about 20 tons, and with fodder and water and men-attendants and provision for these would require a vessel of 80 to 100 tons. It would not be difficult to change the trim of the ship and raise the door above water and push them through it overboard: to embark horses would be more difficult.

Cross-bows stronger than those of usual pattern were common in these days, some being bent and cocked by standing on the bow itself with feet on the two sides of the stock and drawing on the cord with both arms and the back: in describing fighting Joinville writes,¹ "In the evening they brought the King's *foot-arbalatrieres* to us and they formed a line in front of us and when the Saracens saw the feet placed on the stirrups they fled." A bolt from such a machine would penetrate not only personal armor but the sides or bulwarks of ships.

Sickness was very prevalent in the army; from the description it may have been scurvy, so frequent in long sea voyages, and distress was increased by the Saracens posting armed vessels to interrupt food-supply. During these occurrences both the King and Joinville were taken prisoners and Joinville was confined in the hold of a galley: in the *sente de la galie*, "There we were in great discomfort, we lay so close together that my feet were against the good Count Bretagne and his feet against my face," Joinville writes.² The passage shows men could survive in the space between the bottom of a ship and the deck above; very possibly they had to crawl there and could not sit up.

Following these captures negotiations were entered into by which the city of Damietta which was in the hands of the Christians should be surrendered if the King and others were released: as to this Joinville writes,³ "Before Damietta was given up the Queen was put onboard one of our nefs with all our people at Damietta except the sick. By their oath the Saracens undertook to care for these but they killed them all. The engines of the King that they should also have cared for they broke to pieces; the salted meat which they promised to care for because they eat no pork they did not care for it either. They made a pile of the engines

¹ P 135. See cross-bow with ratchet for bending in picture p 422 above.

² *Sentine* is modern French for bilge.

³ Pp 201-7. After Damietta was captured the Queen was left there as regent when the King went on campaign.

one of the salt-meats and another of the dead and set them on fire; there was so great a fire it lasted Friday Saturday and Sunday. Thus God willed x x that we should be delivered. x x We were landed and went towards where the King was x x and there came 20000 Saracens on foot pursuing us. There was a Genoese galley on the river and we could see only one person onboard her but at the sound of a whistle there sprang from the hold of the galley 80 arbaletriers all equipped, their cross-bows bent putting their bolts in place. When the Saracens saw this they fled like so many sheep x x. A plank was laid to the shore for the King to embark x x."

The King promised to pay money and deliver Damietta our authority says,⁴ adding, "Many had advised the King to go aboard his nef which awaited him at sea so that he would be free from danger of the Saracens. But he would not go until he had paid the 200000 livres as he had promised. As soon as the payment was made he went to his nef at sea." All were in anxiety because the Comte de Poitiers was in the hands of the Saracens but learn he is free; "A poor fisherman went to the Comtesse de Poitiers and told her he had seen the Comte free and she had 20 livres parisis given him." The ladies did not stay at home in these days nor in those of the first long voyages in the West 200 years later; they are not mentioned as in ships in the days of the Greeks and Romans nor do they go now but went in the Middle Ages. Great numbers went along in a ship they chartered for themselves when the Spanish Armada sailed in 1588. St Louis' Queen gave birth to a boy while in Damietta; her safety was far from assured and she made an attendant take oath he would cut off her head if the Saracens captured Damietta notwithstanding his telling her he had already determined on this course.

The King sailed from Damietta in a nef and reached Acre in 6 days; the straight distance is 250 miles. While he was at Acre arrived "Monseigneur Alenard de Senaingan who recounted to us how he had taken ship in the Kingdom of Norway which is at the end of the world towards the West and that in the voyage he made to the King he turned around Spain and passed by the Straits of Marocco. He passed through many great perils before he came to us. The King kept one-tenth of his knights. And he recounted that in the land of Norway the nights are so short in summer that the light of the day that ends and the one that

⁴ Pp 213-15.

begins is not seen.”⁵ This means the two lights run together. The other matters of interest regarding the King’s return to France have been given.

⁵ P 271.

Note A: See p 360 n 3 above. In the coleccion de Doc. Meditos III 1865 is the Relacion of Mendoza of the expedition of Menendez sailing from Cadiz in 2 ships for Florida in 1565: when in a great gale, the sea making clean breaches over the ship, “We had 120 men on the deck for there was no other place for them to go: there was only one between-decks which was full of biscuit water wine and other provisions xx. We threw overboard many barrels of water, as well as the cooking-stove and 7 stones we brought to make mills, also the spare rigging and the great cable. In spite of all she lifted little but settled deeper.” This is also in *Voy xx Pub par Ternaux—Compans*, Paris, 1841, 2d ser, 10.

CHAPTER IX.

Throwing-Machines and Gunpowder Guns.

The beginnings of engines of projection have been traced to 650 A D when we hear of Greek Fire; the first form of gunpowder. Mechanical artillery did not disappear when it was learned how to make explosives; so firm was the hold of throwing-machines so many are their good points and so blind was the advance of gunpowder and guns that they were used for 1000 years after the appearance of Greek Fire.⁶ Early accounts connect Callinicus with the appearance of Greek Fire saying he brought it to Constantinople or prepared it there. It was used against fleets of Saracens between 672 and 677 and is said to have been a principal cause of their defeat.⁷ But early writers do not all mention Callinicus. The Emperor Constantine Porphyrogenetus who reigned 842-67 says the secret of the composition was revealed by an angel and commanded his successor as follows,⁸ "Above all you must watch over the liquid fire which launches itself by tubes; if any-one has the temerity to ask you about it as has often been done of me you must refuse and tell them this fire was shown and revealed by an angel to the great and holy first Christian Emperor Constantine.⁹ By the message and by the angel he was enjoined according to the authentic testimony of our fathers and ancestors to prepare the Fire only for Christians in this imperial city and nowhere else. xx The great Emperor then engraved on a sacred tablet in the church imprecations against those who should communicate the secret to any foreigner. xx It happened once through crime entering everywhere that a great person in the Empire won over by enormous presents told the secret to a foreigner; xx one day the offender was entering the church and a flame descended from heaven enveloped and devoured him. All were so seized with terror that none dared afterwards no matter what rank he held to plan much less to practice so great a crime."

This Emperor wrote in 850 that about 340 the composition of a

⁶ Above pp 376, 422, etc for allusion to explosives. Below pp 444-6 is authority that throwing-machines were used until 1550 about.

⁷ Above p 377.

⁸ P 17 Feu Greg Lalanne.

⁹ Constantine the Great died 337 A D. Lalanne adds in a note that Constant Porphyrog says in another place that Callinicus made the Fire known.

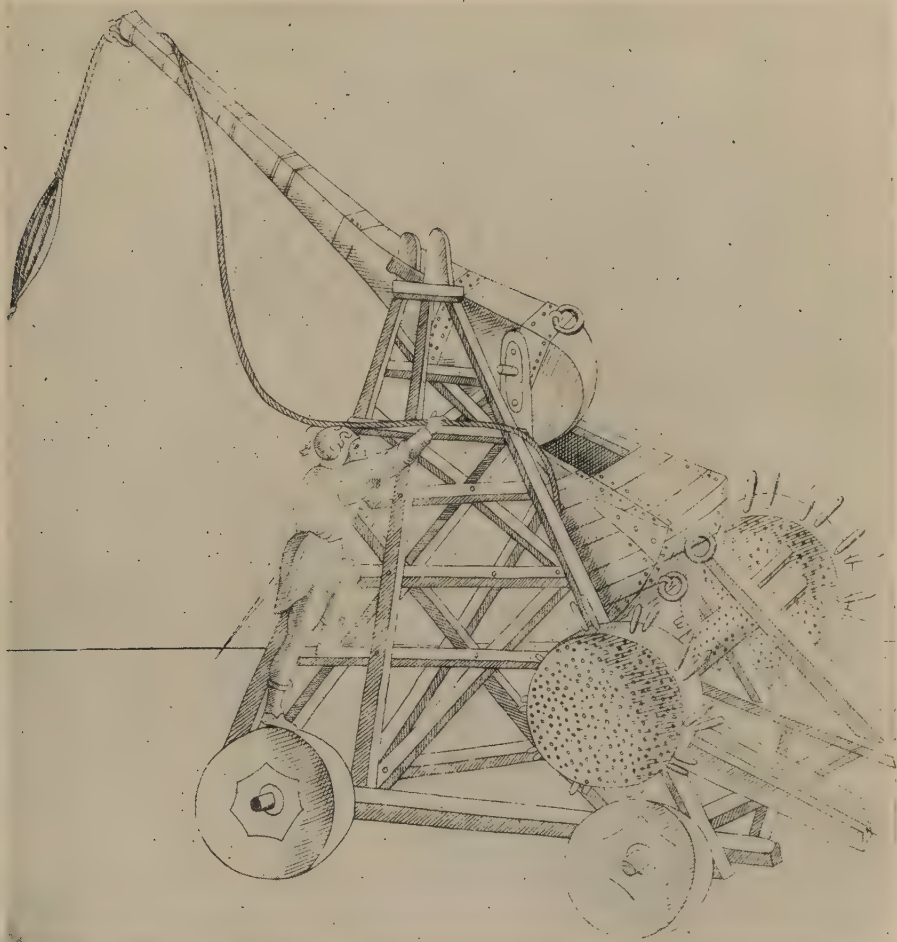
substance, "Which launches itself by tubes," an explosive, was revealed by an angel to Constantine the first Emperor of East-Rome. If we conclude the substance was known 650, 200 years before Porphyrogenetus, we come into agreement with other facts; but the important fact is that explosives were known and used in Constantinople some 1200 years before our day. In 886 Leo the Wise became emperor and in his Military Institutions describes the Fire as an explosive, a projector of itself like the fire from what is now called a Roman candle, and prescribes its use on land and sea. The next to tell of it is Anna Comnena who wrote the history of her father's reign from 1081 to 1118. She does not write as clearly as Leo, but says of an approaching contest with a Pisan fleet that her father's ships because, "The Pisans were strong on the sea fixed lion's-heads made of bronze in the bow of the ships to vomit the fire to frighten the enemy."¹ Our next writers Richard of Devizes and Vinsauf historians of the Crusade of Richard of England mention the Fire only as a violent burner not an explosive.² Ville-Hardouin who tells of the capture of Constantinople in 1204 does not mention Greek Fire, but Nicetas who was in Constantinople when the city was taken mentions it and once as a burster in a shell.³ Joinville who wrote of the Crusade of St Louis in 1248 writes of the Fire, but only of its use by the Saracens, representing the French as unacquainted with it. This is returned to immediately below; but the fact should not surprise us for the sciences were more cultivated in Constantinople and near-by than among western nations. Yet something analogous to an explosive was known in Scandinavia about 1300, for a Norse writing of 1311 called the King's Mirror mentions the *herbrester*, war-crash, report, shown at the court of Eric Magnusson in Bergen Christmas 1294; "It gave," it is recorded, "Such a loud report that few men could bear to hear it. xx Thrand told Laurentius to put his fingers in his ears when the crash came and showed what was necessary to produce the crash; there are 4 things, fire brimstone parchment and tow."⁴ The

¹ Above p 387, where fuller quotation is given.

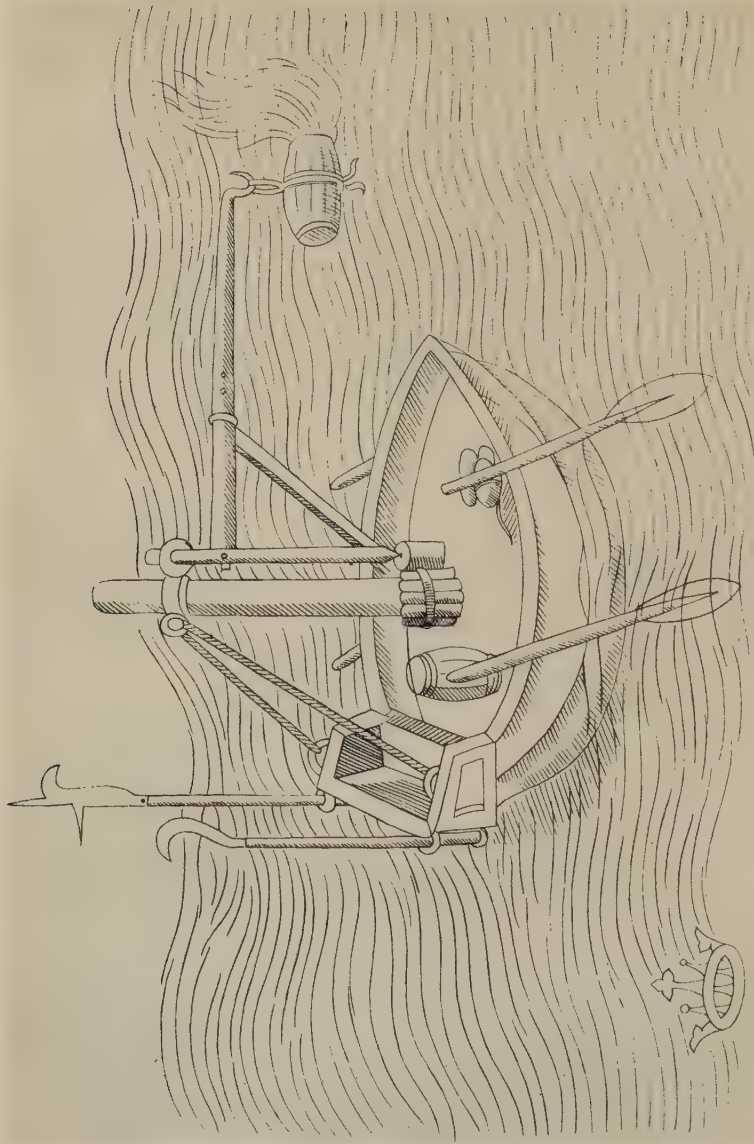
² Above p 407.

³ Above p 423.

⁴ Nansen Northern Mists v 2 p 8. Unless it contained oxygen this was not an explosive. On the same p Nansen says the King's Mirror describes an interesting projectile thrown by machines: a ball of clay baked with numerous small stones imbedded. Nansen says it was used so that the enemy, the ball breaking on falling, should have nothing to throw back, but we can hardly believe the effects of the small stones could have been overlooked. The projectile was not so murderous as a modern shrapnel burst at the proper point in flight but may have been very effective occasionally.



This is pl 6 Feu Gregeois of Reinaud and Favé; p 277 of text says it is, "Taken from a manuscript of about 1400; with it xx it is possible to construct the machine with exactness." These authors call it *machine à fronde*, slinging machine.



N Auncula hinc arborē inq̃ est p̃ca gr̃as caracellū ardentē oportet q̃ fumi cana
 relly r̃uila sine falce ī cadatur ac dimitat sup̃ hostū nauigia r̃uere ut acie
 dātur nauigia p̃fecteꝝ hostum:~

Northmen used throwing-machines in 1110 for when King Sigurd the Crusader besieged Sidon in that year a saga says,

“The Norseman’s King the scalds relate
Has taken the heathen town of Saet:
The slinging-engine with dread noise
Gables and roofs with stones destroys:
The town-wall totters too,—it falls;
The Norsemen mount the blackened walls.”⁵

Joinville writes that a knight, “Received the pot of Fire on his shield; if it had reached any part of him he had been consumed.” The Fire must have been rammed solid into the pot like powder in a rocket or it would have exploded. He says also,⁶ “The Greek Fire comes toward you the size of a cask of wine and the tail of fire coming from it is the size of a great lance. It makes such a noise coming it seems like the thunder from heaven, it seems a dragon flying through the air. It made such a light in the camp that you could see as though it were day because of the great abundance of fire throwing light. Three times they shot Greek Fire at us that night and they fired it 4 times from a cross-bow fitted with a winch. Whenever our saintly King heard they had fired Greek Fire he raised himself in bed and prayed. xx Once when it was fired xx a knight said to me xx, ‘The Saracens have fired so many times their arrows are like a great hedge which comes burning towards our castle.’”

These last were rockets. Leo the Wise about 900 and Anna Comnena 1100 describe the Fire as projecting itself as in a Roman candle, and Joinville in 1250 describes it as carrying a projectile through the air. What we call explosives had come into the world; they had yet to change in proportions of ingredients and way of fabrication to produce a substance in which a burner and supporter of burning, carbon and oxygen or equivalent, lie in correct proportion very near together until a flame is applied. The mixture used in Constantinople about 650 was of this description; oxygen was in it: for the first time in Europe a burner did not depend on drawing oxygen from the air. Callinicus or another had found pitch tar or charcoal would burn in a new and wonderful manner if mixed with a material he knew of; saltpeter or something like it. There is as yet no thought of a gun.

⁵ Laing *Heimskringla* p 157 v 3. See picture here.

⁶ Wailly ed p 133 for first statement and pp 115, 117, 147, 149, for others.

The people of India and China probably knew how to make explosives before 650 A D. A student of the history of chemistry believes the Chinese used a substance like gunpowder from the 1st century of the Christian Era and that Greek Fire always contained saltpeter; was an explosive.⁷ In the East in dry places saltpeter exudes from the ground and when a fire is made on the ground charcoal lies close to it and the deflagrations resulting could not but be cause of remark,⁸ which circumstance has been conjectured to have led to making substances for display on religious and ceremonial occasions in very remote days.⁹ Like the mariner's compass as well as other appliances explosives were developed in considerable part for what are deemed childish purposes: Roger Bacon who died 1292, by which date the use of gunpowder was going forward by leaps and bounds, wrote of it,¹ "It is used in many parts of the earth as a plaything for children." Many works on explosives, among the most important of inventions, will be found and a few other than those mentioned are given.²

THE BURNERS USED IN EARLY WARS.

Powder and guns came slowly and seem to have owed early steps to use in popular shows and in wars. Burning substances were used in pre-historic wars for we find them on the carvings of Egypt and Mesopotamia, in the Bible and Homer. Thucydides wrote of the siege of Plataea 480 B C,³ "The Peloponnesians threw faggots of brush-wood xx into the space between the mound and the wall xx and then lighted the wood by throwing on it fire with sulphur and pitch." Nearly 850 years later

⁷ Hæfer Hist Chimie 2d ed pp 301, 303; see also Hist etc Mendoza Hakl; Mendoza went to China 1586 and says gunpowder was used there much earlier than in Europe, p 128 v 1: as to early use of rockets see Montgery Traité des Fusees 1825.

⁸ Wilkinson Engines of War p 186.

⁹ Traité des Feux pour le Spectacle par M F xx 1747: this author says complicated fire-works were used in China before the discovery of saltpeter.

¹ Feu Greg Lalanne p 79. See above pp 264-5 for what Hirth says of its introduction.

² Lacabane Poudre à Canon in Bibl de l'Ecole des Chartes 1845 2d serie t 1 p 28; Proc Eng Roy Art Inst vs 1, 2, 3, 4, 5; Outline Hist Gunpowder and Gun Clephan, and Ord of 14th and 15th Centuries by same in v 66 2d series 16, 1909 and v 68 2d ser 18, 1911 of Archæological Journal London; Feu Greg et Orig de Poudre Reinaud et Favé text and plates separate; Etudes sur xx Artillerie Emp Napoleon III et Favé 6 vs 1846-71. The last 2 books and that of Lalanne are perhaps the best. The work of Favé and Napoleon is a history of guns profusely and handsomely illustrated. There are references in the books of seamen worth reading: Richard Hawkins understood what we call internal ballistics; see Voy Hakl pp 275-322; also what William Dampier wrote about 1680 Dampier's Voy Masfield 2 vs pp 4 and foll'g v 2; Tartaglia's Colloquies pp 442 and foll'g below.

³ Bk 2, 77. The mound is the wall erected close to the city's walls.

Ammianus Marcellinus tells of engines on walls,⁴ "The fire-bolts which are a kind of missile are made thus: they take an arrow of cane xx and make it in the shape of a woman's spindle with which linen threads are spun; this is cunningly hollowed out in the belly and made with several openings and in the cavity fire and fuel of some kind are placed. Then if it be shot slowly from a slack bow for if shot with too much speed the fire is extinguished so as to stick anywhere it burns obstinately and if sprinkled with water it creates a still fiercer fire, nor will anything but throwing dust on it quench it." Not only arrows had hollow spaces to carry burning mixtures but lances and war-clubs and horses and wagons carried poles thrust out with flaming fires at their ends. Ships carried and threw fire also; we have seen Rhodian ships carried about 220 B C pots containing flaming mixtures on the end of spars thrust out from their bows—a *reply* military books would say to the ram-charge.⁵ Ships also threw pots and lighted substances from machines on the deck of an enemy.⁶

These devices appear primitive and the steps which led to what we employ seem evident, but in early days the end was unknown; the end and road to be followed were unknown. In about 650 A D there was used by the ships of Constantinople a burning substance which projected itself. It was still a long cry to the day of good guns and powder, but Constantine Porphyrogenetus writing about 850 describes an explosive and says it was used 500 years before. An oxygen-holder a substance containing large amount of oxygen had been found and was used. It had been worked out by practical men using dangerous substances, not by reasoning from principles; many are the cautions as to personal safety written in early rules for making burners and explosives. Later than Constantine come Leo the Wise Anna Comnena Vinsauf Joinville and others, all describing explosives. Not one thought of a gun.

MARCUS GRÆCUS.

Many mixtures were tried in search of compounds that would burn violently there being no thought of using it to project itself or another body. Numbers are recorded by Reinaud and other authors; the most

⁴ Bohn ed p 324: the date is 375 A D.

⁵ Above p 161. See pls 8-11 Book of Plates accompanying Reinaud and Favé's *Feu Gregeois* for reproduction of pictures made about 1400 A D showing blazing pots on poles carried by horses and wagons and 12-13 for same projecting from ships. See pictures p 108 above and here inserted.

⁶ Above p 187: see pl 8 Book of Plates cited note preceding for illustrations of thrown fire.

noteworthy being contained in a book called by Marcus Græcus its probable writer *Liber Ignium Comburendos Hostes*, Book of Flames for Consuming the Enemy. Marcus dwelt in Constantinople about 1100 and may have seen Anna Comnena and her father the Emperor, both patrons of the sciences. Manuscript copies of his work are said to have been spread in Europe when the Crusaders who looted Constantinople in 1204 returned home.⁷ One of his recipes calls for a mixture of 6 parts saltpeter 2 carbon and 1 sulphur, about the proportions of modern black powder.⁸

THE BEGINNINGS OF GUNS: GRAINING OR CORNING GUNPOWDER.

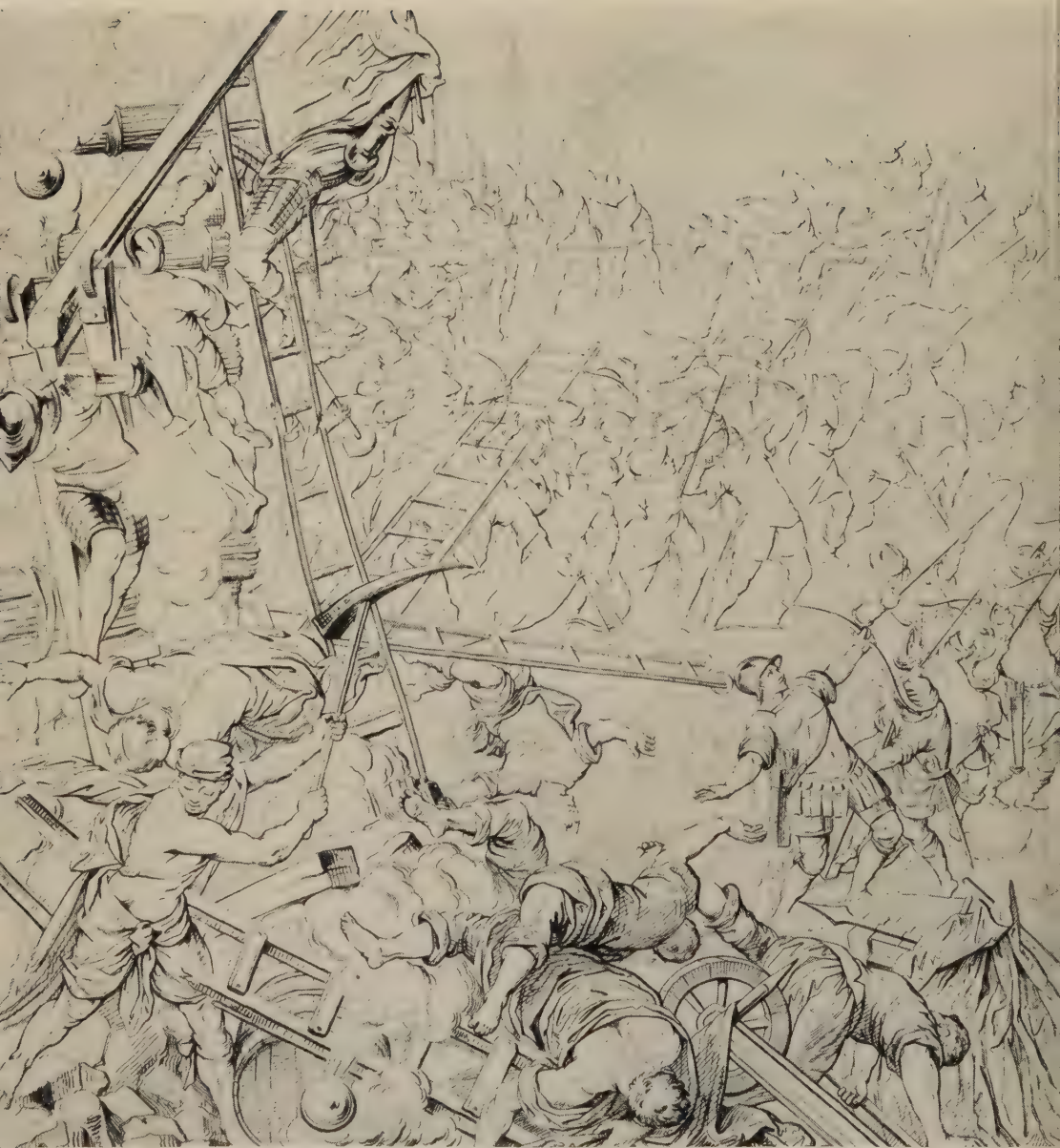
The descriptions of explosives prior to about 1200, up to and including the writings of Anna Comnena and Joinville, are of what we call Roman candles and rockets. These consist of a column of explosive solidly compacted contained in a non-combustible tube. When lighted at one end the explosive burns rapidly but only at that place; the fire does not run the length of the column—unless this is broken, when an explosion often injuring bystanders will occur. The rocket flies with high velocity and the candle would fly if not held by the hand or otherwise. A charge of explosive thus arranged in a gun would not give a projectile much velocity because gas does not form fast. In recipes of about 1100 in Reinaud and Favé occur mentions of passing grains of the explosive broken from a cake through a sieve and of the lumps resulting.⁹ If powder thus *grained* as we call it, *corned* as formerly called, is lighted at any point, the fire runs around the grains through the mass and the surface of all grains is almost instantly burning. To thus light a correctly made charge of powder takes not more than $\frac{1}{5}$ the time the burning of its grains takes and the last should end as the projectile escapes at the muzzle. Since this escape seems to our senses simultaneous with pulling the trigger it is apparent how fast fire goes to every part of a charge over the surface of the grains.

Graining or corning powder is necessary to use it in guns and it appears in history simultaneously with the gun, for in the Middle Age writings found and translated by Reinaud and Favé where we read of use of sieves to corn powder we read also of *bastons*, *canons*, and *bombards*;

⁷ Lalanne Feu Greg p 75.

⁸ Reinaud and Favé Feu Greg pp 79-88; many mixtures will be found. These authors believe at Marcus' date the Arabs made better powder than people of Europe.

⁹ Feu Greg Reinaud pp 79 and foll'g.



This is pl 173 v 3 Zanotto's Palazzo Ducale. The text describes it, "Attack on Zara and victory of Venice over the
and 2 flaming shells of large size are to left: p 423 below as to ex



ians in 1346 painted by Tintoretto." Tintoretto was about 200 years later. Ships are seen in upper part to the left
shells in 1204: the cloud of arrows is probably not exaggeration.

of guns to resist the pressure of powder while urging the projectile to velocity. All this in a general way and much as at present was presently understood, but even now what occurs in a gun when its charge is lighted is known only in part.

EARLY VIEWS ABOUT GUNS AND GUNPOWDER AND THEIR USE.

Reinaud and Favé in their *Feu Gregeois* after giving a number of recipes for violent burners and explosives say,^a "Thus the Arabs knew and employed about 1250 a great number of compounds containing saltpeter; nearly all called *flyers* contain saltpeter sulphur and carbon in proportions approaching those now used." Further on in the same book we read,^b "In a work called *Book of Cannonnerie and Artifice of Fire* printed in Paris in 1561 xx are several short treatises xx believed to be some centuries older: one directs, take of saltpeter 100 pounds of sulphur 25 and of carbon 25, mix them and boil until all are well mixed and you have gunpowder: another, you should measure the length of the *baston* within from its mouth to its bottom and divide this in 5 equal parts; one is to contain the *tampon* one to be empty and the other 3 filled with good powder: another, when you have charged a cannon or other *baston de cannonnerie* and wish to put fire to it to discharge it take your vent-clearer and pass it through the vent by which fire is put into the bottom of the chamber; then put above the vent good train-powder by which the other that is within the *baston* is strengthened and then lay a train to the vent. This done put fire to the end of the train and withdraw that the *baston* may not injure you: carefully avoid laying a train of train-powder without common powder for it is so quick without the common you will not have time to withdraw yourself without damage. xx If you would fire justly and surely avoid firing too high at beginning; otherwise you will not be able to aim and measure the range. Also you must know the weight of your stone and *tampon* as well as the weight of the powder and its strength. And be careful no fire is near your *baston* or the *sac de pouldre* and stand to one side as well in loading as in firing." The gun is a muzzle-loader and its charge was contained in a sack as now.

^a P 32: the word *flyers* is in the French *volants* and the Arab word is given: anything that burns so fast as to project itself or other things is an explosive.

^b Pp 133 and foll'g.

TARTAGLIA'S COLLOQUIES 1588.

We may pass on some 500 years beyond Marcus Græcus for we have in later day good account of artillery, and afterward examine the record of the 500 years passed over. Tartaglia wrote in 1588 calling his work *Three Books of Colloquies Concerning the Art of Shooting in Great and Small Pieces of Artillery* xx and the Cause Why Some Sorts of Gunpowder are Corned and Some Sorts Not Corned. He says that makers, "Do corn fine powder for hand-guns and arquebuses and do not corn the grosse powder which serveth for great ordnance;" that they, "Know not to what end gunpowder is corned for hand-guns and not for great ordnance;" and then gives the reasons.¹ The reason is the large guns were not strong enough to withstand the pressure of powder grained or corned to the right size but could withstand the less pressure of powder in dust. Yet the last is very dangerous; for if as a solid of powder or powder in dust burns a temperature and pressure is reached sufficiently high to shoot fire into it, gas is very rapidly formed pressure shoots up conditions of the utmost danger ensue quickly and the gun probably bursts. The same danger occurs with charges of grained powder only if pressure forms high enough to smash the grains.

There are other note-worthy things in Tartaglia's book: a sketch of peep-sights, but these *di-optra* they were called were used by the Greeks many centuries earlier on throwing-machines: we read, "A piece will not shoot 50 paces nor one pace in a perfect right line:" a gun is mentioned in which, "The concavity or hollowness xx is not *bored* or *cast* right in the middle of the metal:" rules are given for putting sights on guns by firing and noting points of fall of projectiles: he knew that for each bullet and charge there is a correct length for a gun and thickness of its walls: he wrote, "All the powder doth not fire at one instant how fine soever it may be:" he understands the functions of the 3 ingredients of powder, carbon sulphur saltpeter: a sliding tangent-sight like those now used is shown: guns' bores should be inspected for defects by a "steale-glass" and candle on the end of a pole: a gun should be placed 80 paces from a wall to be demolished, "When cannon do lie 200 paces off from the wall which shall be battered they are planted xx in an un-meet place."² As common in works of the day strange things appear; a hot piece of artil-

¹ Pp 78-9 his work: there is a copy in Library of Navy Department.

² Tartaglia pp 2, 12, 24, 25, 26, 32, 69, 78, 37, 53, 59; the last 3 are in the "Appendix of Lucar" bound with Tartaglia's book.

lery will draw sand into its mouth and, "A piece which had oft-times been discharged was made thereby so attractive as that it did suddenly draw into his concavity a little dog which by chance did in going by smell into the mouth of the said piece." It will be of interest to add that Tartaglia is said to be the discoverer of the method of solving algebraic equations of the 3d degree called Cardan's method.

A monk Bernard Schwartz has been said to have "invented" gunpowder without concurrence of others, but the view is no longer held. The claim is curious as is that for another monk, Jean Tilleri, who by some is believed to have given rise to the name *artillerie*, said to be a corruption of *art de tilleri*.³

THE FIRST GUNPOWDER GUNS USED.

The devices described by Leo the Wise Anna Comnena and others to enable explosives to project themselves were guns in the sense the wall of a rocket or Roman candle is a gun; as were also the concavities in lances poles war-clubs etc from which fire issued. In all these pressure was low and the thing projected reached a range of a few feet only. Real guns were used in ships at early date. Prescott in his *Ferdinand and Isabella* ⁴ shows that guns were used in a sea-battle between Moors of Tunis and Seville about 1100, in a land attack on Baza in 1312, and mentions an Arab treatise on artillery of date 1249. Whether the authority for Prescott's statements lived in the day of these occurrences or later has been disputed; but even if its date should be as recent as appears at all likely the events belong in a time when Joinville and others at Damietta saw the projectiles the Saracens fired, 1250. Prescott gives information regarding guns used near Baza: ⁵ there are 20 still in the town and our author says, "The largest xx are about 12 feet in length of iron bars 2 inches in breadth held together by bolts and rings of iron. They were firmly attached to their carriages and incapable of either horizontal or vertical movement xx. The balls were sometimes of iron more often of marble. Several hundred have been picked up many of which are 14 inches in diameter and weigh 175 pounds." A note adds that the Turks used stone balls weighing 600 pounds at the siege of Constantinople in 1453; the bore of the guns being "12 palms," 24 or 48 inches.

The use of cannon by the English at Crecy in 1346 is stated as an

³ Lacabane's work cited above p 438 n 2; pp 47 as to Schwartz and 28 as to Tilleri.

⁴ Tenth ed 1846 v 1 p 306 note; the original authority is stated.

⁵ Pp 385-6.

early date for them.⁶ It is not important to decide where and when guns were first used but there is another well-authenticated case of their use at sea before Crecy: in 1338 the English were planning to land in Flanders and attack the northern part of France and the French King Philip VI hoping to carry the war into England fitted out a fleet; "To the means of attack usual until then in fleets," writes our authority,⁷ "Was added the use of cannon-powder." In the original document the cannon is called *pot de fer* and saltpeter and sulphur by the names we use.⁸ This fleet was commanded by Hugues Quieret and went to sea October 1338: after minor raiding it attacked and carried by assault Hantonne now Southampton but what part the guns played is not recorded.

Also in the volume cited in the 2d note preceding⁹ is the text of an ordinance of the city of Florence dated Feb 11, 1325 giving those of the city right to have made for defence *boulets de fer* and *canons de metal*.¹ There is another case of early use of guns in ships which may be cited, though all countries adopted them in years 1300-1350: at Rochelle in 1371 it is said,² "The Spanish marine covered itself with glory xx thanks to the artillery employed for the first time at sea."

THE OPPOSITION TO GUNPOWDER GUNS.

Though cannons of metal and powder of correct proportions and manufacture were used before 1350 their introduction was not unopposed. The poet Petrarch whose day was about 1350 mentions cannons of wood and Machiavelli wrote in his Art of War of 1500,³ "Nothing occasions greater confusion and embarrassment than to have the sight dazzled or obstructed xx and what can contribute to this more than the smoke of artillery? It is better to let the enemy blind themselves than to go blindfold yourself to seek them, for which

⁶ Froissart ed Kervyn de Lettenhove v 5 p 46 says as to this, "And the English xx fired some cannons they had to dismay the Genoese." The Genoese were probably cross-bowmen, famous in the day.

⁷ P 36 Lacabane's work cited p 438 n 2 above: the official document is given being dated July 2, 1338.

⁸ The Arabs Persians and Turks called saltpeter *baroud* and now call gunpowder by this name, p 15 Reinaud et Favé Feu Gregeois.

⁹ On p 35.

¹ The other words in the ordinance are not given.

² P 119 Etude sur Rel Com xx Flandre Finot. In trans Froissart by Johnes is picture of this action. Finot's book has much regarding early trading in the Atlantic.

³ Eng trans Albany 1815. It is not unlike what Stonewall Jackson said 350 years later, above p 175.

reason I would either make no use of artillery at all, or if I did to avoid censure now great guns are in such credit, I would plant it on the flanks of my army." A few years later Montaigne wrote,⁴ "Fire-arms have so little effect except on the ears that they are about to be given up." Soldiers as well as philosophers had doubts about gunpowder. In Blondel's *Art de Jetter les Bombes* written 1675 it is said mechanical guns,⁵ "Served the ancients xx and threw heavier stones than our bombs;" adding, "Their use is perhaps not to be despised." For his opinion Blondel states as additional reason that a siege-train of throwing-machines is lighter than of gunpowder guns, the construction of the machines being completed only in the place they are used and no ammunition transported.

Folard who died 1752 made most surprising statements as to gunpowder; "It is hardly more than two centuries," he wrote,⁶ "Since catapults were used in the attack and defence of positions. xx They were of greater utility in throwing bombs and stones than our mortars of any size xx." He goes into matters of accuracy rapidity of fire and portability and shows a balance in favor of mechanical guns. Perhaps he means only in high-angle fire: the velocity with mechanical guns never approached that with gunpowder guns and horizontal fire at high velocities is necessary to breach walls in preparation for assault. The employment of guns in breaching walls and in ships against ships calls for fire at low angles and high velocity, and perhaps gunpowder would not have been developed for war if only high-angle fire was necessary since in this throwing-machines were very efficient. Gunpowder made the fire of guns impossible to resist and rendered useless the citadels of massive strength built in many places,⁷ for modern explosive projectiles can breach them, a thing impossible when cross-bows of wood or steel to be bent and cords to be twisted were used in horizontal fire.

Vauban the great military engineer of his day 1690, a century before Folard, wrote of the attack and defense of places and throws light on the status of artillery. He says a citadel may be captured in 48 days with

⁴ Gravière Dern Jours Mar à Rame; Montaigne's date is 1533-92.

⁵ P 582. Blondel writes of theory of parabolic motion of projectiles, originated by Galileo and applied by himself he says, and of sighting cannon and mortars; that is of sights for horizontal and vertical fire.

⁶ Pp 240-2 v 1 *Abregé Com de Folard* Paris 1754. Folard's work is pivotal in the history of war but the complete edition I have never found.

⁷ The walls of Babylon were 32 feet thick and 100 feet high surmounted at short distances by towers 10 feet higher, *Fortification Enc Brit* 9th ed.

the aid of gunpowder guns and lists the stores necessary having regard to its strength and situation.⁸ There are other things of interest in the work; to wit, guns placed 1000 to 1200 yards from a wall cannot breach it and only make a noise: ricochet-firing, bouncing projectiles along the ground, was first used about 1688, small charges of powder being employed: all powder was corned in Vauban's day: mention of *mortiers* from 12 to 33 inch bore using explosive shells with *fuze* fitted: soldiers carried tin or wooden measures by which to measure charges and lead-bullets were cast near the firing-line: guns were injured by too great pressures in proving: some guns had screw breech-blocks which are, "Reduced by $\frac{1}{6}$ or $\frac{1}{7}$ of their thickness by cleaning 30 times a year:" guns are of forged or cast-iron or brass and bored: some guns have percussion-locks. It is now barely a century since ships' guns were fitted with percussion locks and about the same time since they adopted explosive shells fitted with fuzes.⁹

FABRICATION OF GUNS AND OTHER DETAILS.

Guns were at first as again in modern day built-up not cast in one piece. Brantome a noted gossip of about 1550 refers to the beautiful cast guns in France which he says,¹ "One may fire without fear 100 shots one after the other so to speak without bursting;" earlier, guns were, "Necessarily often refreshed with vinegar and other things." Before those of rings and bars of metal guns were made of wood silk or other material. From Tartaglia's book² it appears about 1500 some were cast hollow and others bored, but because of lack of machinery we may be sure large guns had bores cast in them, these being probably smoothed out by boring. Small and middle-sized guns were breech-loaders and used an equivalent for the metallic cartridge-case of modern breech-loaders; each was provided with several breech-ends in which cartridges were placed, which were dropped into the base of the bore and wedged there against a stirrup when about to fire.

The following statements in Harris' History of the Royal Navy are of interest;³ in an account of arming an early Saxon war-ship no "engine"

⁸ Sieges Att et Def des Places 1829 pp 40-9 v 2. The other quotes are v 1 pp 107, 115, 164; v 2 pp 72, 97, 102.

⁹ See above p 423 as to explosive shell 500 years before Vauban's day.

¹ Brantome Lalanne 11 vs p 78 v 3. Heavy guns of modern day might fail in the test here mentioned.

² Above p 442.

³ V 1 pp 80, 89, 184, 23, 339, 373; v 2 pp 49, 106, 185, 444.

appears: King Richard's Articles for the Government of the Navy when he goes on Crusade are given: a cut of same date (1190) showing ships grappled: in a ship to carry the King and Queen cabins are "wainscotted:" in 1323 two Venetian merchant-vessels arrived in England: in a fight off Zierikzee in 1304 there were, "One or two *springalds* in each Genoese ship," probably from the name standing cross-bows: the sea-battles off Sluys 1340 and Les Espagnoles sur Mer 1350 are described but there is no mention of standing guns: Edward II invaded Scotland in 1327, his army being provided with, "*Crakys* of War:" "it is manifest that cannon formed a part of the armament of many ships by 1338 and about 1372 guns and gunpowder were commonly used:" "guns both brass and iron are repeatedly mentioned in the reigns of Richard II, acceded 1377, Henry IV and Henry V." Authorities are given.

GUNS IN SOUTH EAST EUROPE.

Many who have examined the development of gunpowder are of the view that much was accomplished in the 3 centuries the Turks were warring between Constantinople and Vienna. In 1683 they were forced to raise the siege of the latter city and of the guns used on the occasion there is good account. An authority writes,⁴ "The number of pieces of artillery furnished by the imperial arsenal for the defence of Vienna was 262 xx. In 1650 a Jesuit of Warsaw invented the elevating-screw as a substitute for the quoin xx. The 262 pieces were of capacity from 1 to 48 pounds xx and in case of mortars for vertical fire and discharging stone shot from 60 to 200 pounds. There were of these 4 of 200, 2 of 150, 5 of 100, and 10 of 60." The quoin was a wedge which was placed under the breech when raised or lowered by a man with a handspike until the man aiming the gun said it was correctly laid; then the quoin was jammed in and held the gun in place. Quoins were generally used for ship-guns until 1850 notwithstanding the invention of the more convenient elevating screw.

THE GUNS AT CONSTANTINOPLE WHEN THE TURKS CAPTURED THE CITY IN 1453.

The rivalry of merchants has often given rise to fighting and not long subsequent to 1204 the Genoese deeming themselves affronted by a favor the Emperor of Constantinople had shown the Venetians, "Threw in

⁴ Sieges Vienna by Turks trans from Schimmer.

broad daylight without reason or pretext a great stone from one of their machines into the middle of Constantinople." The Genoese apologized upon inquiry; they did not know who had done it but supposed it was the chief of the machine; he would be punished. The next day they threw another stone into the city from the same machine.⁵ The stone was thrown about a mile: from Galata across the Golden Horn into Constantinople. There is no statement about its size. The Turkish army which finally captured Constantinople had a powder gun which threw a stone of probably about the same size a mile. As to this a gun-founder⁶ born in Hungary left the service of the Emperor in Constantinople and enlisted with the Turks. Being asked if he could make a cannon to throw a stone to break the wall of Constantinople he answered he could make one to throw whatever stone he pleased, he knew exactly the thickness of the walls and could reduce them to powder even if they were as strong and solid as the walls of Babylon: "I know all that depends on my art but cannot say what the range of the guns will be," he said. "Make me the cannon, for the range I will see what can be done" replied the Sultan; "A quantity of iron was collected the founder made a mould and in about 3 months he made a gun of prodigious and terrible size." So writes our author.

The gun was cast at a distance from Constantinople and brought to the city: "60 oxen were harnessed to 30 wagons for this purpose and 200 men walked on the sides to prevent its falling over; 50 workmen and 200 machines prepared the roadway and built bridges." In 60 days the gun reached Constantinople. The Sultan came to see it; the founder, "Chooses the stone measures the powder and loads:" our historian goes on, "They published that the next day the gun would be fired for fear of what might happen if people were not informed beforehand. The next day fire having been put to the powder the stone came out with fearful noise and the air was filled with thick black smoke. The sound was heard at 15 miles and the stone went a mile making a hole in the ground 6 feet deep." A little further on⁷ we are told

⁵ P 110 v 8 Cousin Hist Constant.

⁶ P 362 v 8 Cousin's Hist; this is in a writing of Ducas a co-temporary. As will be shown presently this gun was very large and must have been cast with bore in it.

⁷ P 379. Hammer Hist Emp Ottoman trans Hellert 1835 v 2 pp 380-98 tells the story of this gun saying it took 2 hours to load; it perhaps did but this is not in Ducas' history in Cousin. Hammer says the gun-founder's name was Orban and that the gun burst killing him.

in firing the gun, "The cannoneer had 2 stones one very large and the other smaller. He fired the little one first for a trial to see if the gun was well laid and then the other." Scientific gunners will see fault here as the small stone would not range the same as the large one. Several cases of this gun's being used are mentioned but not that it burst. The only remaining fact of interest regarding it is this, "The inventor of this detestable machine⁸ had a secret to prevent its bursting. I have seen cannons break as though of glass when they threw a stone unless covered immediately with a very thick piece of woollen material. Even when thus covered they burst often after a third shot because of cold air penetrating the pores. But what was his secret? When the cannon had fired and was all heated with the powder and sulphur he put oil within it which resisting the air which insinuated itself in the pores preserved the cannon until it had destroyed the walls of the city. It remains to serve the Tyrant whenever he chooses."

With this gun and others the walls of Constantinople were breached; a thing mechanical guns could not have done. One can only guess the gun's size and power but it could hardly have been less than 20 to 24 inch bore carrying a stone ball 400 to 600 pounds weight. It must have thrown its ball at 700 or 800 feet per second. If it projected a 600-pound ball at 800 feet velocity its power to use the modern term was double that of a 9-inch smooth bore gun of 50 years ago, which projected its 90 pound ball at 1500 feet.

Reinaud and Favé write,⁹ "Gunpowder artillery originating in the countries between Hungary and the Black Sea must have come to western Europe by 2 different ways, by Germany and by Italy." These authors do not refer to the gun made by the founder from Hungary but must have been familiar with the History of Ducas. The Turks had been fighting more than a century north of Constantinople before capturing that city and their armies had been for centuries in Syria Asia Minor and regions near the Sea of Marmora before they passed to the north of Constantinople. Never was need for good appliances of war greater than that of Christian nations of these days.

⁸ P 380; the writer is Ducas, a Christian of a family of Constantinople some of whom were emperors and co-temporary.

⁹ Feu Greg p 221.

THE SCIENTIFIC USE OF GUNS; MARINO SANUDO AND CHRISTINE DE PISAN.

Ancient and mediæval writers tell few details regarding use of guns but from 2 Italian authors of about 1350 when gunpowder guns were few it follows that the rules now recognized as controlling use of guns were formulated and accepted before that year; that is by use of mechanical guns. Marino Sanudo wrote regarding guns about 1320,¹ "On this subject the engineers and experts in the army should employ their very sharpest wits, for if the shot of one army whether engine-stones or pointed projectiles have a longer range than the shot of the enemy, rest assured that the side whose guns hath the longest range will have an advantage in action." The active part of Sanudo's life was about 1300 and he may never have seen a gunpowder gun. The engine-stones he mentions are stones of more or less irregular shape thrown from machines of the swinging-beam type and the pointed projectiles are arrows bolts or other long missiles from gunpowder guns or cross-bows in horizontal fire; a long projectile would go end over end if thrown from a machine of the former class. Even from cross-bows either man-carried or standing long projectiles might go end over end. Arrows shot from bows were feathered to rotate them and bolts from cross-bows were fitted with inclined fins of wood or metal for like purpose as shown in the picture p 368 above.

Christine de Pisan the first "modern woman" some say wrote of guns. She was born in Venice 1363 and lived in France where she supported herself. She tells, having it from soldiers and seamen who if asked whence came their information would have replied, "From the ancients,"—she tells of what has come in our day to be called *spotting* and of *tracers*; the names are modern but the process of the ancients. Christine wrote,² "If at night projectiles are thrown they should have attached to them burning brands for the light shown by the fire makes known the range of the engine and the weight it is best to put on it."³ That is the point of fall should be *spotted* by the *tracer* as gunners of today would express it. Our

¹ Sanudo's works have not been translated: the quotation is from foot-note p 166 v 2 Cordier's Yule's Marco Polo. Pp 158-69 same v is information about mechanical guns including illustrations.

² Livre des Fais et Bonnes Mœurs du Sage Roy Chas v par Christine de Pizan; tomes 1 & 2 ser 1 & 2 Nouv Coll Mem pour Servir à l'Hist de France xx Michaud et Poujoulat. There are many eds of Christine: this one gives the original and modern French. The Boston Public Library has it and possibly others.

³ In Christine's French this is "et se par nuit on trait on doit lier tisons de feu ardents aux pierres qu'on trait car par ce tison pourra l'on savoir comment l'engine gecte et combien pesant l'en y pourra mectre."

authoress writes of mechanical guns: if asked to amplify she might have added; "I mean that the burning brand shows where the stone falls; then the gunner consults his table and finds that as it fell 100 yards short he must add so-many pounds to the weight that swings the beam to make it turn faster and throw further."

She writes of a swinging-beam machine and though her Book of Arts and Good Deeds is nearly all about operations of war neither gunpowder guns nor saltpeter are mentioned; it must have been written before 1375 for Charles V of whom she wrote reigned 1364-80. So spotting and tracers, adjusting gun-fire by noting or spotting the place where shots fall and correcting the gun's angle and velocity according to the distance from the target this is, and putting a light or tracer on shots at night so this can be done, are older than gunpowder guns. There is indication indeed, not to say proof that this was done many centuries earlier yet: Diodorus wrote about 30 B C of the bombardment of Rhodes in 305 B C; ⁴ "The night being very dark no moon appearing fire-brands flying about with great violence gave light to the night, darts and stones from balistas and catapults not discerned when shot, wounded and galled many of the combatants who could not see how to avoid them:" the commander on this occasion had, "Fenced ships round xx made loop-holes in the sides and placed in these engines to shoot darts and arrows of 3 spans' long at a great distance, together with such men as know well how to make use of these x x." There is another evidence the fire of guns has long been brought to the target by observation of the points of fall. Fournier wrote in about 1650, ⁵ "Beyond point-blank it is impossible for any man to strike a small object at the first shot," implying he can strike it at subsequent shots. In former days the expression point-blank was much used and like many phrases had no precise meaning. A shot begins to fall as it escapes from the gun. Perhaps a good way of defining point-blank is this: if a gun is directed at a point in the side of a ship at the same height as its bore and fired; then if the distance of the ship aimed at is such that the projectile will reach it in the same time it will fall to the water, the projectile strikes the water-line: further, if the ship fired at move toward the gun she will always be struck. The distance between the gun and ship

⁴ Booth trans v 2 pp 487, 477; see above p 100.

⁵ Hydrographie, p 107: see p 441 above for mediæval statement about regulating fire.

is point-blank range: 100 years ago with guns about 15 feet from the water it was 800 yards; now it is more.

Going forward to about 1700 we find maxims which serve today as do Sanudo's and Christine's. About 1700 an Englishman wrote; ⁶ "French guns go further ours make a bigger hole. The French have the advantage to fight at a distance and we yard-arm to yard-arm. xx Their ships are broader and carry a better sail our sides are thicker and better able to receive their shot." The maxims of Sanudo Christine de Pisan and our later writer are unalterable.

There are other statements in Christine's book: she says Aristotle wrote; ⁷ "Those who go on the sea and do not know all the dangerous passages should have them painted on a map to be able to avoid them and this should do he who conducts or commands an army." Aristotle died 322 B C. This passage I have never seen in Aristotle's works but in Christine's day there were probably copies not now extant. "Hollow arrows may be made," she says; ⁸ "And here introduced a compound of oil sulphur black pitch and resin enveloped by oakum that is lighted; these are thrown by cross-bows on the enemy's engines and if thus a quantity is thrown it will be wonderful if a fire is not started." In the chapter just noted we read of placing alongside throwing-machines a forge, "In which iron red-hot and flaming is prepared and thrown on the enemy's engines." As to war on the sea she has evidently read Vegetius ⁹ for she says men in ships should wear much armor as they remain in one place and that ships, ¹ "Should be well provided with vases filled with pitch resin sulphur and oil mixed and enveloped in oakum. The vases should be set fire to and thrown on the round-ships and long-ships ² of the enemy; then they should be attacked vigorously to give no time to put out the fire." Then follows how to break ships with great spars shod with iron hung from aloft and swung against them, how large iron arrows should be fired at sails to tear and pierce them, and how ships should be grappled with hooks. Finally, "Provision should be made of fragile vases filled with lime or dust to blind the enemy. Also soft soap should be thrown to render the deck slippery

⁶ Steinitz The Ship p 263.

⁷ Pt 2 ch 31 ed cited.

⁸ Pt 2 ch 37. There is no saltpeter or equivalent here: the black pitch was to make the mixture adhere long at the point struck thereby communicating fire.

⁹ Above p 363.

¹ Part 2 chap 38: again no saltpeter, it is only a burner.

² In Christine's French these words are *nefs et galeres*; by her day there were round-ships sailing-ships as well as long-ships in battles.

so that the enemy may fall overboard: there should be provision of sailors who can swim long underwater to be provided with tools to pierce the enemy's bottom." The last may be classed as submarine warfare; it would be very effective if tubes containing Greek Fire were inserted in holes bottom.^a As to throwing soap when ships were grappled the men fought with sword and buckler standing on raised parts and good footing was necessary.

STANDING CROSS-BOWS IN BROADSIDE BATTERIES IN 1275.

Somewhat before Christine's date is mention of throwing soap on decks and other things of interest: Alfonso the Wise King of Castile 1252-1284 laid down in the *Siete Partidas*,³ "To fire there shall be balistas to starboard and port and darts and stones xx and soap to make them fall." This means ships were to carry broadside batteries of standing cross-bows; the statement of Diodorus just above as to fences in ships in which were loop-holes and engines in these to shoot long darts and arrows in the year 300 B C means the same. It cannot escape attention that we hear of many devices and appliances, compasses astrolabes mechanical and gun-powder guns in ships tables for reducing ships' reckonings charts etc, in about the same time; in the 11th and 12th century. They had been long in preparation; that is in use. The date furnishes a resting-point as does that of Diodorus that Demetrius used guns in ships against other ships in 304 B C, placing them in port-holes fitted with shutters. In the same days occur the only references I can recall to throwing-machines of the swinging-beam type in ships; the Crusaders used them in attacking Constantinople in 1204 and just below is a mention of them for a special purpose.

THE FIGHTING RANGE.

In days when the line was composed of row-ships contests were bloody affairs depending on personal strength, skill with sword and buckler, and ferocious and savage courage. The Athenians describe a way to make the ships do the fighting; battles were to be won by destroying the ships; but it is doubtful if they made use of this. In their day and after we read of ramming and of projectiles fired but probably few battles were decided by these. In the Middle Ages when ships mounted gunpowder guns

^a P 384 above for mentions of submarine warfare in 490 B C and 1084 A D.

³ Cited p 481 n 2 below: the passage is also p 28 note Lalanne Feu Greg.

contests became less affairs of personal strength and prowess. Richard Hawkins a gallant and intelligent English seaman wrote about 1590 200 years after the day of Christine de Pisan, in which space of time the long-ship had disappeared from war-fleets, her place being taken by round-ships, sailing-ships;—he wrote that English seamen disapproved of boarding: some captains,⁴ “Being examined and asked why her Majesty’s ships on occasion board not answered and informed that it is the express order of her Majesty and Council in no case to hazard her ships by boarding; xx but in the hour that her Majesty or Council committeth the charge of any of her ships to any person it is left to his discretion to board or not to board as the service requireth.” English ships until the sailing fighting ship disappeared, contrary to the practice of others, Spanish French and Dutch, sought to reduce the enemy by gunfire before approaching to board.

Hawkins says inspectors take glory in bursting guns in proof, adding he would not have a gun in his ship which had been proved with a charge greater than its service charge.⁵ He lays down the following, “He that purposeth to annoy his enemy must not shoot at random nor at point-blank if he purpose to accomplish with his devoir; neither must he spend his shot and powder but when a pot-gun may reach his contrary; how much the nearer so much the better, and this duly executed the shorter gun will work its effect as well as the long xx. But here my meaning is not to approve over-short pieces which at every shot they make dance out of their carriages but those of xx betwixt 7 and 8 foot.” If he had in mind 24 pdrs a largish gun in his day but not uncommon he advises guns about 20 calibres long; 20 times the diameter of bore in length of bore. This is a fair length, such guns would have a velocity of 1200 to 1500 feet per second and their point-blank range would be about 700 yards.

What Hawkins writes about range is as correct and full of meaning today as when written. Random range, extreme range we name it, is the range when the gun is cocked up as much as its mount will permit; to 6° or 8° in Hawkins’ day and 30° now; point-blank is reached when the gun is level. Hawkins approves the employment of neither but advises one at which powder and shot will not be spent and where a pot-gun may reach the enemy. Probably he means by pot-gun what would be meant now; a scatter-gun of large bore numerous projectiles and low velocity such as

⁴ Hawkins *Voy Hakl* p 292.

⁵ Pp 252, 277.

hunters use to shoot for the market. Undoubtedly he means a gun of short range. Hawkins' doctrine was adhered to in the 300 years following his day and was firmly fixed. In the day when oar-vessels carried gunpowder guns and earlier, short ranges ruled.⁶ This has been reversed in our day: it is believed gun-fire will be effective at distances approaching *random* range; *rover* range it was called by bowmen, the furthest an arrow will sail in the air. The reversal is justified many maintain by betterments of guns: let us examine these; (1) the distance to a target can be measured by instruments before the guns are fired a little more accurately today than in the day of Hawkins: if asked whether the range in Hawkins' ship, say 750 yards, could be measured by instruments closer than a range of 15000 yards can be today the answer is affirmative. Besides adjustment of range by distance-finding instruments it is adjusted by observation of points of fall of projectiles, by *spotting*: a spotter at 750 yards could work closer than at 15000. In regulating fire guns of Hawkins' day were better off than those of today, each working at ranges advocated as proper. (2) Guns are themselves a little more accurate than in Hawkins' day: no-one knows the exact improvement; but the *pattern*, the area on a vertical target placed at 750 yards range containing all shots fired by a gun of Hawkins' day held in the same place, would be smaller than one so made by a modern gun at 15000 yards. We are taking Hawkins' range at 750 yards which he would probably believe too much. His point-blank—distance a shot will range while dropping 15 feet—was not more than 500 yards. Captains of ships have been called before courts-martial for exceeding point-blank range and to exceed it was prohibited by Fighting Instructions of the British Navy. The point-blank of modern guns the same distance above the water, since their velocity of projection is about double what it was in Hawkins' day, is double that of his guns; about 1000 yards. When modern guns are firing at 15000 yards the range is 15 times their point-blank; as 15 times 500 is 7500 the last is a similar range for earlier guns. (3) The third matter affecting fire is the motion of the ship causing apparent motion of target. This remains the same as always. The line of sight and prolongation of the bore sweep up and down across the target in a small fraction of a second, during which the projectile must leave the gun to reach the target. Given proper seaway ships roll as deep as ever, and though most modern ships take a longer time to make oscillation

⁶ Below pp 507-8.

than ships of Hawkins' day and their angular speed is lower, yet their sight-line and bore cross the target in a fraction of a second. Targets are not enough larger than formerly to count. The line of sight of a gun in a rolling ship crosses a target at 15000 yards in $\frac{1}{20}$ the time it is on a target of the same height at 750 yards.

The last is a heavy handicap: to sum up, guns are themselves at ranges adopted not more accurate than formerly; the ways of adjusting their fire to the target, again at ruling ranges, are less good; the gunner's apprehension of the moment his gun is on the target must be far more acute than formerly. There is not reason for the ranges now advocated, nor can they be justified by the wars of the last 50 years, the period of adoption of rifled guns and elongated projectiles. They are a heresy, a misjudgment. There have been heresies in former days: for some of these navy officers have suffered and they will be held responsible for failure and success alike. In the war lately closed the doctrine of long range led to the failure of the sea-force of the Allies, which though it very materially outnumbered the force of its opponent produced large results of passive character only. It will be a new day for navies to assume potential and not active rôle; if ships-of-the-line play the part of fortified places on land.

GUNS AND THEIR MOUNTINGS.

In this place the history of guns and their carriages will be brought to the present time. The means by which the gun and mount is turned is seldom shown in early pictures. It has been mentioned that mechanical artillery is pictured on the stones of Nineveh,⁷ that the engines are of the swinging-beam class, and that their date is about 700 B C. The pictures do not show how these were turned. In a writing of 30 B C we have the first account of the use of throwing-engines in sea war, ship against ship, the events related having occurred in 306 B. C.⁸ This is the beginning of the history of ship-guns, though guns were used in ships against fortifications by Pericles in 439 Nicias in 427 B C⁹ and no doubt at earlier date. The engines in ships were cross-bows firing at high velocity in flat trajectories. This follows from what Diodorus writes; especially the following about the siege of Rhodes in 305 B C;—vessels, "Fenced round with planks and boards and loop-holes in these where were placed engines to

⁷ P 96 above and plate p 96.

⁸ P 99 above.

⁹ Pp 97-9 above.

shoot darts and arrows 3 spans long xx." No one would shoot a dart or arrow 3 spans long by a swinging-beam machine. In these operations it is told that, loop-holes, port-holes, and port-shutters were fitted.¹ The port-shutters were, "To shut at pleasure" Diodorus wrote. Until now guns using vertical fire low velocities and large angles fire over a parapet, having usually no indentation or port in this covering. Guns for fire at low angle and high velocity have an interruption or port-hole in the covering through which the muzzle passes.

Thus histories of early wars show shooting engines were used in ships; knowledge of circumstances afloat leads us to look for ship-guns to employ flat trajectories and high velocity and the records indicate that such was the case; finally at the date when the records tell of guns in ships against ships 306 B C several authors describe high-power throwing-machines, large cross-bows. The writings of 5 of these, all but one of date 300 to 200 B C, have been printed in a work by Wescher called *Poliorce-tique des Grecs*,² but the work remains in the Greek with notes in Latin. It includes illustrations of siege-engines, among which large cross-bows are numerous but there are no illustrations of machines operated by a swinging-beam. The engines of this class were used in reducing fortified places until displaced by gunpowder mortars in 1550 to 1650³ and broke towers and houses but could not break walls; nor could this be done by great cross-bow machines. The earliest case of breaking walls appears to have been at Constantinople, which as has been seen⁴ was by gunpowder guns. The illustrations in Wescher's book are not deemed to have been made at the dates at which the manuscripts were written but at later periods and completed and restored in modern days. They include 4 pictures of ships⁵ but none show throwing-machines. There are in ancient and mediæval books mentions of throwing-machines in ships⁶ but nowhere a picture of one I think except the swinging-beam one shown by Yule onboard Marco Polo's ship represented going into battle off Curzola in

¹ It has been said Descharges a shipbuilder of about 1500 A D made the first port-holes. These are too obvious to come so late: not only Demetrius the admiral referred to in the text but Archimedes a few years later built port-holes. Lindsay *Hist Mer Shipping* v 1 p 402 shows an English ship with port-holes with protruding guns: Lindsay does not state its date but it must be about 1400.

² Printed 1867: this word means Siege Science. See also *Chirobaliste d'Heron d'Alexandrie* par Prou in *Inst Acad Inser Notes et Eatr* v 26 pt 2 1877.

³ See above pp 444-6; what Folard and Blondel say: also above p 101.

⁴ Above pp 447-9.

⁵ Pp 33, 34, 269, 270.

⁶ The most satisfactory is p 453 above.

1298, and Colonel Yule expresses doubt whether it should be there.⁷ The picture is a spirited one being made under the direction of Yule and is I feel sure correct except the throwing-machine.

The cross-bow throwing-machines in Wescher's book are better shown in a paper called L'Artillerie des Grecs by De Rochas⁸ and throwing-machines are illustrated and described in Payne-Gallwey's Projectile-Throwing Engines of the Ancients. The large cross-bows shown by De Rochas can be moved vertically and horizontally. Of these machines there was great variety and they had many names which in most cases show something of how they were used; there were also many names for the machines operating by swinging-beams. There are allusions to throwing-machines in the writings of Flavius Josephus who wrote in Syria in the first 50 years of the Christian Era,⁹ and as he wrote of the siege of cities many of the machines are of the swinging-beam variety. Vegetius and Ammianus Marcellinus who wrote a little before 400 A D and Procopius whose date is 530 A D tell of machines in an army and of both kinds. Being in Rome and besieged by the Goths Procopius writes; ¹ "Belisarius prepared machines called balistas. These are the shape of a bow xx. When they are fired the 2 extremities of the bow are drawn near each other xx and in the hollow an arrow is placed. This is shorter than ordinary arrows but 4 times thicker and in place of feathers has little pieces of wood of the same form. When an iron point is placed on this several men wind up the machine on both sides. The arrow is shot with such impetuosity that there is no tree or stone it will not strike in pieces. These were placed on the walls also machines proper for casting stones, these are called *onagers* and are like slings." Procopius says an arrow from a cross-bow machine passed through a man and pinned him to a tree.² The Emperor Maurice who reigned in Constantinople 582-602 wrote a book called Strategicon in which he describes how to launch a bridge across a river in the face of the enemy. He employs ships at the advancing

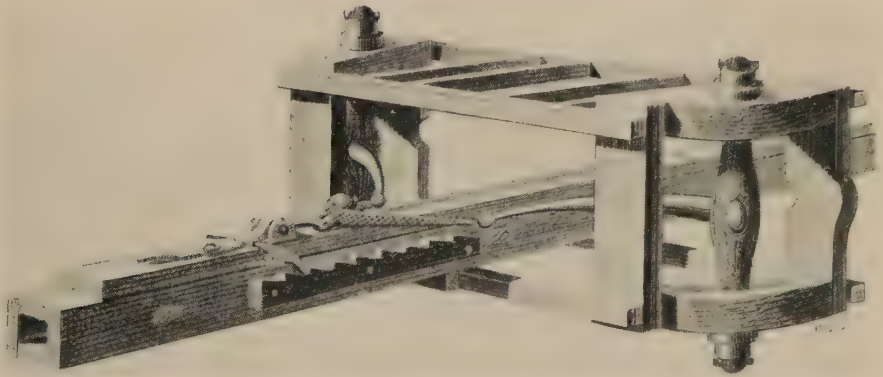
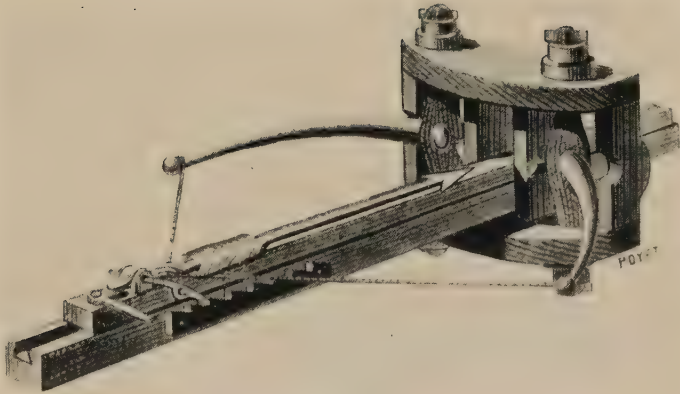
⁷ Note p 38 Introd Cordier's Yule's M Polo; p 48 for illustr.

⁸ La Nature June 9 1883 no 525 p 26. In nos 511 Mch 17, 1883 and 526 June 1883 are papers on Instr de Geodesie and La Science dans l'Antiquité. The last has much about measuring speed of ships. A picture from De Rochas is here given.

⁹ Works of Josephus xx by Wm Whiston 5 vs Wars of the Jews.

¹ War with Goths pp 417-18 v 1 Cousin's Hist Constant. The *onagers* were swinging-beam machines.

² Cousin's Hist v 1 p 422, a brave Goth, "Stood near a tree armed with a helmet and cuirass and fired incessantly on the walls. He was struck by an arrow from a machine in a tower on the left and pierced through and through as well as his cuirass and pinned to the tree."



This is p 29 La Nature for June 9, 1883, no 525, article by De Rochas called Artillerie des Grecs.
The way these were turned in vert and horiz planes is described; also their range.

bridge and arms the men with, "Little balistas covered with mantletts."³ This is an early mention of man-carried cross-bows which like man-carried fire-arms came later than heavier pieces of their kind.

Mechanical artillery continued to be employed until 200-300 years after the beginning of gunpowder guns, having points of vantage over the last and both power and accuracy.⁴ Julius Cæsar tells of the great penetration of engines at Marseilles when besieging that city.⁵ By 1500 powder guns were in all ships meant to fight. They were often small-bore breech-loaders and should have had firing-locks and elevating-screws for these existed, but ship-guns rarely had these until about 1850. For the same reason guns should have had before 1600 sliding sights adjustable for different ranges surmounted by a peep-sight; but these also they were long without. Fournier who died 1652 writes in his *Hydrographie*⁶ of movable sights for ship guns but in the way of suggestion rather than as articles of usual equipment. The most inferior part of the equipment of ship-guns was the carriage. These are now excellent, the beginning of their marked increase in efficiency coming not before 1875. For years the mounting of ship-guns was a block of wood with small wheels at the front and sometimes rear, a stout rope called breeching to stop recoil when the muzzle was within the port-hole in position to sponge and load, and hand-spikes and side-tackles to haul the gun right or left, while vertical position was controlled by handspikes and a wedge-shaped piece of wood called a *quoin*.

Long-ships row-vessels carried gunpowder guns in a line across the bow of the vessel, a heavy one amidships and 2 or 3 smaller on each side; 5 or 7 in all. To use more guns they were fitted to carry them in broadside above the oars; but these in turn disappeared and sailing-ships came in carrying many guns on the broadside. Though arrangements for pointing were primitive, yet so skilful quick and strong were gun's-crews 50

³ P 203 v 2 Maizeroi's trans Inst Mil Leon le Philosophe; in a résumé of Maurice's book.

⁴ See p 440 v 2 Cordier's Yule's Polo for picture of attack by Portuguese under Albuquerque in 1513 on Aden; a note in middle p 166 same volume says the picture was made by an artist of the day. There are many swing-beam machines with slings flying from their upper ends mounted on the towers of Aden while gunpowder guns show in port-holes in Portuguese ships: see p 474 below.

⁵ Comm Civ War 2, 1: his words are given above p 104. See above p 102 for his remarks as to accuracy of fire.

⁶ P 107.

years since it was not uncommon to put 2 round balls on a target 8 to 10 feet square at 1000 yards range in a minute. It was given in the day as the reason for poor equipment that hands before the mast did best with simple things.⁶

A SWINGING-BEAM THROWING-MACHINE IN OPERATION IN A SHIP ABOUT 1300.

The Crusading fleet that assaulted Constantinople in 1204 used these machines from ships to throw missiles over the walls into the city and Alfonso the Wise speaks of cross-bow machines in broad-side batteries of ships about 1250; but the case now to be recounted is of special character: in the Chronicle of Alfonso XI King of Leon and Castile 1312-50 we read that a Christian admiral to relieve a city besieged by Saracens,⁷ "Had 2 *trabucos* mounted in 2 naves and with these trabucos threw them sacks of flour. And the Saracens placed 2 *engenos* with which they fired at the 2 naves in which were the trabucos." Bags of flour could be thrown by the long steady impulse of a swinging-beam but would be broken by the violent one of a cross-bow; the *engenos* were standing cross-bows firing on the ships, whether from ships or the land is not mentioned. It may be added fragile pots carrying burners lime soap or serpents could be thrown better by swinging-beams than cross-bows.

EQUIPMENT AND APPURTENANCES OF GUNS.

Fournier wrote about 1650,⁸ "In round-ships 200 guns have been placed but present experience shows that 60 are enough for the greatest *galions* and *carracks* it being impossible to give a greater number the proper distance one from the next to prevent the fire from one gun firing the next gun." Large charges of explosive particularly when not correctly proportioned and well worked fill space around a gun with flame extending many feet. Fournier does not say how far apart guns must be

⁶ Pyrard a Frenchman wrote of Portuguese seamen in 1605, "The mariners are very much respected and there are very few of them but can read and write such being needful for them for the art of navigation; yet there are few good at it though all have the name; theirs is the work of steering the ship each in his turn xx. They do all the work that has to be done aloft xx;" p 200 v 2 Voy Pyrard Hakl: about 2 centuries after Pyrard's day Cook had his bluejackets working out lunar observations for longitude and doing it as well he says as professional astronomers with him.

⁷ Bibl Autores Espan v 66 p 249 Rosell ed Madrid 1875.

⁸ Hydrographie 2d ed p 95. Carracks were the largest round-ships, pure sailing-ships of large burden; galions were also sailing-vessels but not so large and using oars at times.

but does say the French man-of-war *Couronne* of 1630 was 200 feet long over-all with 44 feet beam. With 200 guns in 2 complete lines there would be 50 on each side on each deck; or making some allowance at bow and stern the guns would be less than 4 feet apart: if 60 guns were mounted they would be 12 feet apart; quite near enough. It is to be observed that in the day ships-of-war rarely mounted guns in complete lines from bow to stern. Until a period comparatively recent it was the custom to expose powder during battle not only at the touch-hole of the guns but in piles of cartridges; and because the number of loaded cartridges prepared was insufficient barrels of powder were brought on the gun-decks their heads knocked out and powder scooped from them as required. We have account also in land battles of mixing powder at the firing-line of troops; saltpeter sulphur and carbon being brought there separately, measured out placed in a vessel and incorporated by pounding and working. It may be noted Portuguese ships which began about 1430 the voyages south which led to rounding the Cape of Good Hope carried no guns⁹ though those going to war did. By Magellan's time 100 years later all large ships bound to unknown or hostile coasts carried guns. The tendency was to over-gun ships and many are the statements of racking hulls and causing leaks by firing guns, even when saluting, a custom much indulged in.

GUNS AND GUNPOWDER IN THE FAR EAST.

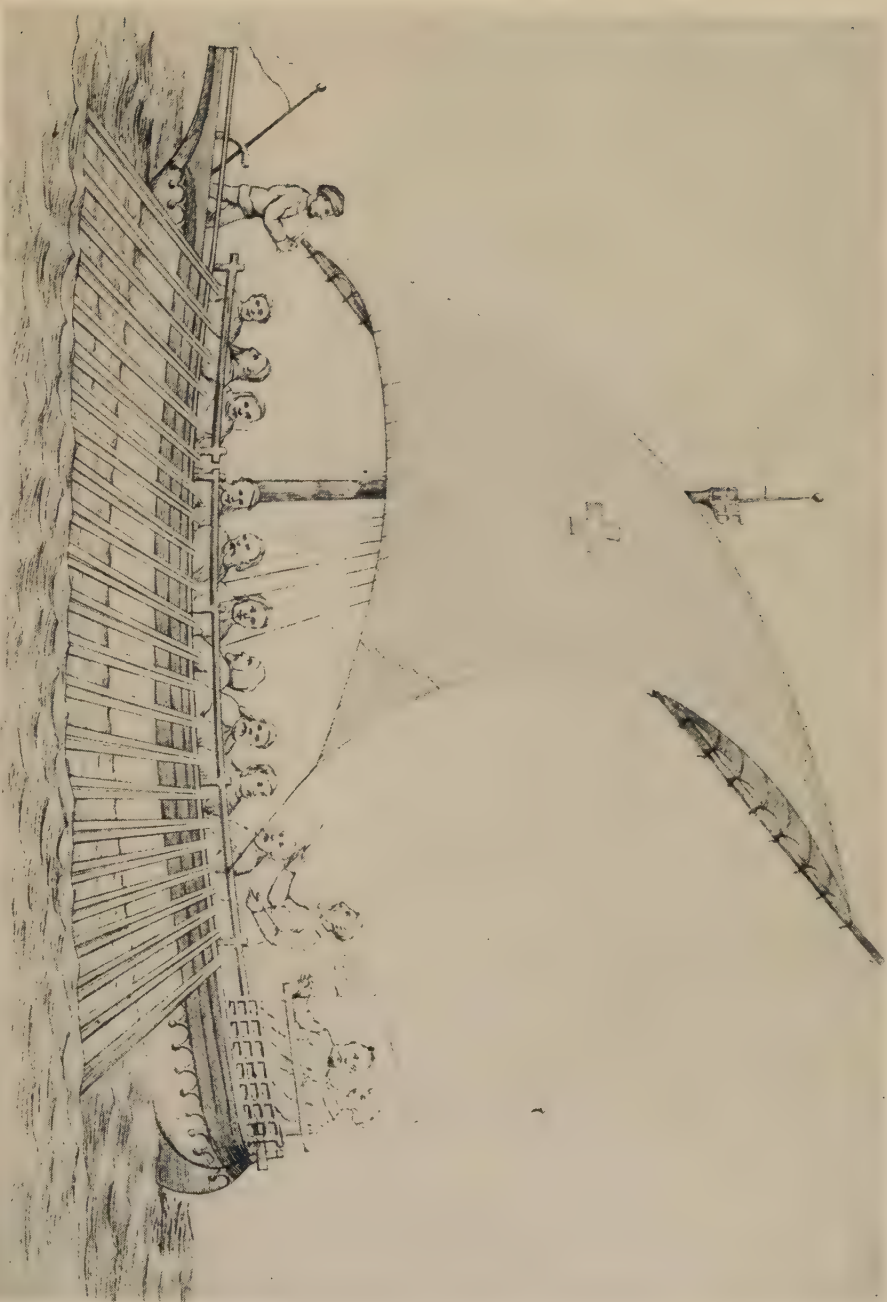
It is believed by some explosives were used in the East earlier than the West; almost certainly to display fire-work and possibly in war as well; and is mentioned above that the view has been expressed that gunpowder like the compass was known in China earlier than in Europe while the useful application of both was made in the West.¹ As going to show that explosives and guns were used in war in early day by the Chinese the following passage in a serial called *T'Oung Pao* is quoted: it is in the number for 1902 and reads, "In de Mailla's History of the Sung dynasty is a description of the siege of Khai-fung by the Mongols in 1232 A D: it is in part as follows, 'There were then at Cai-fong-fou *ho-pao* or *fire pao* xx in which powder was placed; this taking fire burst like a clap of

⁹ Disc and Conq Guinea Azurara Hakl v 2 p 254: the Ports in contest with natives have only cross-bows, the natives have bows and arrows and thrown stones; Azurara was co-temporary.

¹ Above pp 264-5.

thunder and was heard at more than 100 *ly* xx; no cuirass no matter how good but it would pierce.'” A little further on is this, “Besides this terrible machine the *Kin* had a kind of *flying javelin of fire*: as soon as the powder they put in this took fire it went more than 10 paces and made mortal wounds. These machines were what the Mongols feared most.” The writing containing the passaaages is by Professor Schlegel and much contributory evidence is cited. The date is a little before Joinville saw flying-fire in Egypt and before we hear much of guns in Europe.

From Fincati's *Triremi* at pp 325-74 v 2 *Com e Mem of 3d Inten Geog Congr at Venice Sept 1881*. This has been separately published: see word *Fincati*. Beneath the picture is, "Facsimile of a bireme on the sea-chart of Graziosa Benincasa, Ancona, 1482." The rowing is zenile and this had passed away before 1482. See p 503 below as to galleys proceeding with both oars and sails: this picture is defective for the oar blades are in the water the men are not rowing and the ship is sailing with good breeze. The picture of zenile rowing at p 85 shows not only the oars at each thwart but the rowers as well which this one does not show.



CHAPTER X.

War-Ships from the End of the Crusades until Now.

The wars in the Holy Land came to a final ending when Acre was lost in 1291. Acre has often been taken and re-taken by military forces even until modern days, and though there were no ships present on this last occasion they had often played a part for it was a principal port of entry. There is a co-temporary reference to military affairs at Acre in a letter written by Jean Pierre Sarrasin who was in Syria about 1250, the time of the Crusade of St Louis; he wrote, "And while the war lasted there were always 80 *naves* or more loaded with goods and supplies in the port of Acre. And all that year there were 40 *engiens* that threw on the city of Acre on its houses and walls and towers and struck to the earth all these, for there were 10 *engiens* which threw such great and heavy stones that they weighed 1500 pounds weight of Champagne; so there were thrown down all the towers and fortresses of Acre except only the religious houses."³ Acre was taken by assault May 18, 1291.⁴ The year is memorable in the annals of the sea, for it is also that of the first attempt of Westerners to reach the East by sea; the voyage of Doria Vivaldi and other merchants of Genoa out at Gibraltar with purpose to go to India,⁵ an undertaking attempted by Eudoxus 1000 years earlier.⁶ It was due only in part to Saracen hostility that Christians were driven from the Holy Land. The Turks in their progress west reached Mesopotamia by 1000 and captured Jerusalem 1076 holding it then a time only. They had no ships; but when they captured Constantinople in 1453 they took over the navy of that city and their fleet became the terror of the Mediter-

³ See Michel's ed Joinville with which Sarrasin's letter is usually bound p 308: the letter says of the fire on another occasion there were so many missiles with Greek Fire, "It seemed the stars of heaven were falling," p 96.

⁴ Hist Chev xx S Jean de Jerusalem Bosio ed Baudoin Paris 1643 2 vs. Bosio was a Knight of St John, a seaman-soldier and contemporary with much in his History. See also Chev de Malte Gravière.

⁵ Above pp 304 and foll'g.

⁶ Above pp 201 and foll'g. As to commercial reasons for finding a sea-route east see Hist Com entre Levant et Europe Depping and Route to India by xx Red Sea Pringle Edinburg Journ Science 1826 no 8. Depping shows merchandise sold in Europe before ships went by the Cape at 60 to 100 times original cost in the East, p 77 v 1.

anean; a condition which lasted in some degree until when shortly after 1800 this country led the way in forcing better manners on them.

THE KNIGHTS OF MALTA.

When driven from Syria the Christians established themselves in the near-by island of Cyprus; the Knights of St John afterwards called of Malta establishing themselves there in 1290. Cyprus had been captured by Richard of England in 1191 and given to the princes of Lusignan who held it until 1489, when Catherine of Cornano the last of the line sold it to Venice; it was taken by the Turks in 1571 a month before they were defeated by the Christian fleet at Lepanto.⁷ For nearly 500 years the Knights were famous in resisting advance west of the Turks; for it had become a question of saving Christendom.

They called themselves *The Religion* and well they deserve the appellation for they were long the outermost bulwark of Christianity. The order took rise from the grant of a Saracen caliph of Egypt to merchants of Amalphi about 1023 to build a hospital in Jerusalem for care of Christian pilgrims. They remained in Cyprus until 1310 when they conquered Rhodes and settled there beating off a fleet sent the following year to drive them away. For 200 years they remained in Rhodes until in 1522 the Sultan of Turkey Solyman the Magnificent came himself with a fleet carrying 100000 soldiers and heavy guns. The capital of the island was invested the end of July and fell 5 months later upon exhaustion of ammunition and food, it being one of the articles of capitulation that the Knights should leave the island within 12 days and be carried to Europe in Ottoman ships; a condition honorably fulfilled by Solyman.⁸

Christian power had not been at so low ebb for many centuries; for after the Knights were forced to withdraw only Cyprus remained in Christian hands and this they were to lose in 1571. In accordance with the terms of capitulation the Knights were carried to Crete and thence to Sicily, and in 1530 the Emperor Charles V granted them Malta and Gozo where they abode until the dissolution of the order: not the least of their services was furnishing the great Admiral Suffren to the French navy in their last days. The galleys of *The Religion* comparatively few in number were in all battles of the day posted usually in the place of greatest

⁷ There is a history of Cyprus by Lœher 1878 and another of the reign of the Lusignan Paris 1852. Until our day the fortune of the island depends on the sea.

⁸ Bosio p 102 v 1 as to Siege Rhodes: also pp 103-10 Gravière's Doria et Barberousse.

danger; in the battle of Previsa in 1538 the expedition of Charles V to Algiers in 1541 and battle of Lepanto in 1571. Within their fortifications at Malta they withstood the Turks in 1551 and again 14 years later when the citadel was invested in May and frequently assaulted until September but always without success: during the last siege the famous Turkish corsair Dragut was killed.⁹

THE SHIPS OF THE KNIGHTS; METAL SIDE ARMOR.

The Knights owned large ships. One Bosio says,¹ "Had 4 decks above water and 2 in the water covered with lead and shot-plugs of bronze which lead does not spoil like iron which could be applied so quickly that the cannon of a whole army could not have sunk her. She had a chapel a cabinet of arms for 500 men a salon chamber and ante-chamber for the grand master and a council a *finel* for the Knights and officers, an oven and hand-mills to cook every day, galleries flowers in boxes around the poop, a forge. It was never necessary to pump out the bilge unless water came in from above. She carried 50 pieces of great artillery and a great number of other and smaller guns. Her mast was so large it required 6 men to embrace it."² This ship was present in the attack on Algiers in 1541 where her guns were of much service. A mast requiring six men to embrace it would be some 10 feet in diameter; the passage is worded as if the ship had one mast only. It is probably because of this passage that modern authors mention metal ship armor at this time.³ Bosio must have seen the ship and his words cannot be explained except on supposition the lead was vertical side armor; the bronze non-corroding plugs increase the likelihood of this for they would neatly fill a hole made by a shot. Fifty years earlier than the date of this vessel ships had lead strips covering their seams to prevent the caulking from working out and causing leaks.⁴ Metal side armor may be much older than the date here indicated for

⁹ Gravière Chev de Malte v 2 p 1. See also Bosio where p 485 and foll'g v 1 the circumstances of the siege are told. Bosio was in the garrison.

¹ P 332 v 1: see again p 497 below as to this ship.

² The words translated *covered* and *shot-plugs* are in the original *revestus* and *buchons*. The allusion to lead not spoiling bronze strengthens the conclusion the lead was vertical side armor; the date is 1550. In 300 years following armor is not again mentioned as built into a ship though ship's sides were protected by what may be called *jury* armor. I have been unable to find the word *finel* in dictionaries.

³ See André Doria A Condottieri Admiral 1466-1560 Petit; in this p 197 is written, "Doria sheathed a ship with plates of lead and bronze about 1530 and used her in battle;" Du Sein Hist de Mar de Tous Peuples v 2 p 24 note.

⁴ Above p 350.

Diodorus says ships in 304 B C had, "Ramparts that were fenced with iron." ⁵

THE TURKS IN EUROPE.

When the Christians abandoned the Holy Land the power of the Turks was rapidly rising their armies conquering far and wide; but they did not at this time have ships and did not go to the sea until after taking Constantinople in 1453. During the days from the abandonment of Syria by the Christians till Constantinople fell, 1291 to 1453, the Knights were in Cyprus Rhodes or Malta, and if western states possessing ships, Catalonia Genoa Pisa Venice and others, had sunk their jealousies, it is probable the Turks could not have maintained their armies in Asia Minor and south-eastern Europe, to advance to the walls of Vienna and capture Constantinople. But there was no action by Christian nations: their ships passed to and fro in pursuit of gain often plundered by ships of the Saracens until when the Turks made a navy Saracen and Christian ships alike were burned and robbed and over-sea trade sunk to a low ebb. The Turks were of a strange and ferocious race and though they had in their day many ships they contributed little to the art or science of sea-faring: they destroyed trade in the Mediterranean and made attempt on that in Asian waters, for Solymán the Magnificent sent Sidi-Ali to Bassora in the Gulf of Persia to bring a fleet thence up the Red Sea to Suez. Sidi was created Admiral of Egypt and claims to have beaten 25 Portuguese ships with 15 in the Strait of Ormuz and a few days later 34. These battles were in 1553 and afterwards Sidi went to India but accomplished little and returned home by land. He says he wrote a book about astronomy but it has not been found. ⁶

THE COMMERCIAL STATES OF THE WESTERN MEDITERRANEAN.

Barcelona Marseilles Genoa Pisa Amalfi Venice and other cities in the western Mediterranean were in their day the bulwark and hope of Christendom. It appears as though if they had backed the Knights in far-away Rhodes, planted in the very jaw of the enemy, the Turks could not have remained in Europe; but they had each their own troubles,

⁵ Booth's trans 1814, 20, 4. E A Freeman who doubtless made his own trans of Diodorus in his *Hist of Sicily* v 3 p 480 cites Diodorus' mention of ships covered with iron.

⁶ *Jour As Soc* IX 1st series 1826 p 27: the original author was Admiral Sidi: see below p 498 for further reference to the Turks in the East.

citizens being not unmolested by feudal lords and under necessity to assure their own position before going abroad to meet an enemy. It has been seen that the commerce of Greece and Rome, and before the day of these of Egypt Crete and Syria, is very old. We cannot indeed find the beginnings of these nor those of the cities named: near Genoa organized sea-traffic may be traced back of the beginning of the Christian Era; about 170 B C Paulus Æmilius was sent with a Roman fleet to punish the Ligurians who we are told,⁷ "Had some strength at sea and their corsairs plundered and destroyed merchant-ships as far as the Pillars of Hercules. xx The Ligurians xx delivered up their ships xx and Æmilius carried them off leaving them not a vessel bigger than those with 3 banks of oars." Thus the Ligurians predecessors of the Genoese built ships not unlike those of the Romans and throughout the western Mediterranean merchant-ships were numerous enough to make it worth while to cruise for them; ships going for the purpose from Genoa to Gibraltar. The sea history of the coasts near Genoa is perhaps as old as that of Marseilles, founded by Greeks about 600 B C. Sismondi dates the beginnings of the political life of Venice from the invasions of Attila in 452 A D when the fisher-people and others near-by sought refuge in the marshes near Venice thus leading to the formation of a single government in 697. This author writing not long since says, "The republic of Venice was a few years since the oldest state in Europe."⁸

A NOTICE OF THE WARS OF MEDIÆVAL CITIES.

The ways of trade are those of peace it is said but trading often leads to fighting and no wars have been more unremitting and remorseless than those of commercial states in the Mediterranean in mediæval days. The hostilities of Byzantium and the cities of Italy were as bitter as those engendered by religion and seemingly purposeless and wanton. They began in the struggle of the Italians to be free from the East-Roman empire and independence on the sea was usually enjoyed before the cities themselves were free. The struggle began in early days; we have seen something of it in the operations of the fleet sent to Italy under Belisarius about 530 A D. Battles were frequent from about 680 A D because of Saracen attacks on the islands and efforts of Christian peoples to drive these out. Many were

⁷ Paulus Æmilius Plutarch Langhorne trans v 2 p 159.

⁸ Hist Rep Italiennes du Moy Age Nouv ed v 1 p 298. There is a smaller edition in English.

the alliances entered into by cities and often these were broken by allied fleets coming to blows with the result that war was declared. So fierce was the rivalry that there was danger of war whenever fleets were in presence of each other and in foreign lands where merchants were domiciled.

The fighting force of several cities was of respectable size before 1000 A D and a trading fleet must have been long in existence before. We may conclude cities quarrelled without reason but must admit they were the fore-front in that struggle for civic and personal liberty and striving for the beautiful and useful in science and art which issued so gloriously. It is said the first war of Italian cities was between Lucca and Pisa who fought a great battle on the sea in 1003. The records of Amalfi are also very old; this city as well as Venice Pisa and Genoa had ships on the coast of Syria and at Alexandria before the Crusades, being occupied in trade and the transportation of pilgrims, and it thus fell to them to convey Crusaders and supplies and join the fight against the Infidel. Being virile people with arms in their hands they came easily to fight with those who in all places but the Holy Land were bitter foes.

THE WARS AND DOWNFALL OF PISA.

Amalfi was captured and sacked by Pisa in 1135 having been taken about 75 years before by the famous Norman viking Robert Guiscard. It was a place of trade and had merchants and ships in the Holy Land before 1023,⁹ and though despoiled by the Pisans in 1135 must have owned ships later, for an Amalfitan Flavio Gioia is often alluded to as the discoverer of the polarity of the compass in 1302. The Amalfitans were avenged in 1284 when Pisa was brought low by Genoa. There is record of Pisa's operations at sea in 1070 in an attempt to win from the Saracens the Balearic Islands. In 1115 she sent a fleet of 300 ships under Archbishop Moriconi which captured these¹ the fleet returning with rich booty and 20000 captives, Moslems and released Christians; 70 extra persons in each of 300 vessels whose normal complement was probably a little more than 200. These were the days of the wealth and splendor of Pisa and not long after the famous Leaning Tower and Campanile were built.

The Pope rewarded Pisa's service by granting her sovereign rights in Corsica, which aroused the jealousy of Genoa the island being distant

⁹ Above p 464.

¹ Capmany Mem Marine Barcelona v 2 app p 39 for list of the fleet: original documents as to fleets of Ven Gen and Pisa in 12th-14th centuries are given.

barely 100 miles and she declared war. Hostile relations continued until 1241 when a Genoese fleet conveying prelates summoned by the Pope was beaten by a Pisan fleet near the island Meloria off Leghorn. Many churchmen were drowned in the action and devout persons were not surprised when Pisan and Genoese fleets met in the same place 43 years afterward, that is in 1284, and that of Pisa overwhelmingly defeated. The sailors of Pisa moved to Genoa; if you would see a Pisan go to Genoa it was said.

This battle unlike the first at Meloria had great results and its story has been preserved. The Genoese line-of-battle consisted of 77 galleys under command of Uberto Doria, the Pisan of 86; both fleets formed in single straight line: in the rear of the center of the Pisan line was the island Meloria and hidden behind it Doria posted 30 of his fleet, but we are not told how far away these were. The main parts of the fleets, 77 and 86 in numbers, charged, and when they were grappled fast to each other, the men standing on the rail fighting with sword and buckler, the 30 hidden Genoese ships put out from behind Meloria; Sismondi says,² "While the 2 fleets almost equal in number were engaged the reinforcement of 30 Genoese galleys driven impetuously by the wind struck the Pisan fleet and sunk 7 vessels instantly. xx The loss in this battle ruined the maritime power of Pisa xx; all the fishermen of the coast quitted the Pisan galleys for those of Genoa."

The sea-wars of the day cannot be followed to useful purpose; sometimes their cause is not clear; hardly ever can their principal operations, their grand strategy, be discovered; and as to battle-tactics the little we find is so distorted by prejudice as to be under grave suspicion. Pisa was 2000 years old when she fell at the second Meloria for the city is on the site of an ancient city of Etruria: she may be older than Rome. She remained important at sea after Meloria for she had a treaty with Henry VII of England 1485-1509 according to which English wools were to be shipped only to Pisa and Venice and in Pisan and English ships.³

THE BATTLE OF CURZOLA.

This was fought in the Adriatic 14 years after the 2d Meloria, that is in 1298, between the Genoese and Venetians. Curzola is an island 60 miles east of Lissa where Italian and Austrian fleets fought in our day.

² Hist Ital Republics Eng trans p 109: a diagram of the battle is given p 526 v 1 Du Sein Hist Mar.

³ Depping Hist Com entre Levant etc p 380 v 1.

Marco Polo commanded a ship at Curzola and was made prisoner; being taken to Genoa he was confined with Rusticiano de Pisa who was captured at the 2d Meloria and who wrote out Marco's Travel Book while in prison. The Genoese fleet at Curzola under command of Lamba Doria consisted of 95 galleys and that of Venice under Andre Dandolo of a few less. The Genoese admiral,⁴ "Detached 15 vessels to gain the wind. They attacked the Venetian fleet already engaged with the rest of the fleet in flank. xx Only 12 Venetian galleys escaped, the Genoese burned 66 and took 18 to Genoa with 7000 prisoners." On the following page of Sismondi is this, "In 1295 the Genoese equipped 160 galleys each one manned by 220 men, all natives of Genoa or the Riviera." The muster-roll of the fleet was 35200; the ships were a little larger than those at Salamis 1800 years earlier for these carried 200 men. In this battle as at Meloria we see the striking results of surprise and what is now called a Flying Wing.

VENICE AND GENOA.

The wars of Venice and Genoa are not better recorded than those of Pisa. Above is account of Genoese seafaring before the Christian Era and that of Venice began probably not later. Genoa had always interests in the eastern parts of the Mediterranean and Black Sea and maintained them against Saracen and Turk Venetian and Catalan until the discovery of the Capes of Good Hope and Horn turned commerce into new channels. Venice was harder to drive from the sea than Genoa for she remained there until her territory was over-run in the days of the French Revolution. Of her wars the most celebrated is that of Chioggia with Genoa; this began by a fight near the mouth of the Tiber in 1378 usually called Battle of Antium and was closed by a treaty signed 1381; Chioggia is said to have been the first war in which gunpowder played large part.

ANOTHER BATTLE WON BY ATTACK OF A FLYING WING.

There was a battle near the Bay of Naples in 1528 in which the attack of a squadron held in reserve won the day. French and Imperial armies were contending for the city of Naples and 8 galleys under Philippino Doria nephew of Andrea were sent to succor and supply the French army, invested in Naples by forces of the Empire. Upon its arrival Hugh de Moncada assembled a squadron of 6 galleys to drive it

⁴ Sismondi Hist Repub Ital v 4 p 242, Fr ed.

from the bay. The story is from the History of Sandoval written about 1600 and as follows; ⁵ "The fleets being in sight of one another steering for the contest, Doria seeing Moncada had only 6 galleys xx ordered 3 of the 8 he had to fly to return when signaled, and confronted the enemy's 6 ships with 5. But 2 of Moncada's were unwilling to fight and took flight. With the remainder a great fight was made and many were killed on both sides with arquebuses and muskets. The victory inclined to the Imperial fleet for 2 galleys had surrendered, xx but just at this moment the 3 galleys which had gone away returned to the succor of their friends. The galley of Moncada had suffered greatly for Doria's had fired a piece called *basilisco* which raked along her central gangway from bow to stern whereby were killed 40 official persons and many good soldiers. xx Moncada was killed by a shot in his side and upon his death his galley was surrendered and captured as well as the 3 others."

SAILS IN BATTLE.

Greek and Roman ships used sails to make passages and come into or fly from battles but their use to bring them actually into line-of-battle must have been rare and the only one I am aware of has been given.⁶ In special cases as at Meloria and Curzola they were used in mediæval times, and the Venetians having lost an entire fleet of 60 row-galleys in battle with the Saracens in the Gulf of Otranto in 840 A D put round- or sailing-ships in the line-of-battle.⁷ Scipio used round-ships at anchor on the coast of Africa about 200 B C but owing to immobility in weather suitable for row-ships they were rarely in actions. Yet though materially less weatherly and controllable than now they made short work of row-ships in a seaway with a breeze.

GUNPOWDER GUNS.

Several cases of guns in battle have been mentioned. The Catalan author Ramon Muntaner chronicles an important fact about guns in ships, saying that in 1325 2 *navires* round-ships beat off a fleet of *galeres* galleys.⁸ These *navires* probably had gunpowder guns yet the date is early

⁵ Hist Vida y Hechos Carlos V p 6 v 2. See also Gravière Doria et Barberousse p 163 where the action is called Battle of Amalfi.

⁶ Above pp 165-6.

⁷ Formaleoni Essai sur Mar Venetiens trans d'Henin p 32: Daru Hist Rep Venise 3d ed p 343 v 3.

⁸ Chron Muntaner Hakl pp 292-4 v 2; see trans Buchon also where the vessels are called *navires* and *galeres* showing their class; see pp. 495-6 below.

for these in ships. Row-ships formed the bulk of fighting fleets in the Mediterranean long subsequent to this however, for such were the ships at Previsa and Lepanto, 1535 and 1571, though at both these there were round-ships also. At Previsa these were the cause of the indecisiveness of the action. The 2 fleets the Christian under the great admiral of the day Andrea Doria and the Turkish under his rival Barbarossa met at Previsa off the Gulf of Arta in September 1535, there being round-ships in the Christian fleet only and the Turks out-numbering in row-ships. As was usual the row-ships mounted several guns which could fire ahead but none to fire on the beam while the round-ships had heavy broadside batteries. On his round-ships joining Doria prepared to fight; but Barbarossa steered away, his fleet in the form of a great eagle we are told. As the Christians came on it fell calm whereupon, the round-ships falling behind, Doria ordered his galleys to cease rowing; Barbarossa willing to fight only if Doria's round-ships were out of it caused his fleet to lie on their oars and await the enemy. Bosio says,⁹ he may have been in one of Doria's ships, "God calmed the wind suddenly which stopped the *galions* and *navires* without which Prince Doria did not wish to fight, Barbarossa stopped so the Christian *galeres* might advance without the *navires*. The Christian crews wished to fight without the *navires* and murmured against the Prince saying he had become cold with age." The affair was indecisive.

This is an interesting chapter in naval history: the *galeres* were row-ships pure and simple mounting 5 to 7 guns which could fire ahead only, the *navires* round-ships pure and simple, sailing-vessels with almost no power to row mounting guns on their broadside—perhaps 20 or 30 of a bore that would even now be considered fairly large, for early guns were often large. The effect of these on the light-built row-ship was murderous as she approached to ram. *Galions* were intermediate vessels: large with fair oar and sail power and a line of good-sized guns on the broadside mounted above the oars; a compromise vessel, a sign of the passing of the row-ship, not far away in 1535 when Previsa was fought. The classes of the ships described by Bosio is not the only interesting thing in his account; the men said Doria was cold with age; he was 72, he was born in 1466 but did not retire from service until 18 years later when 90 years of age, dying 4 years later.¹ We find *galions* at Lepanto 1571 36 years after Previsa when the Christians had 7 and the Turks none. The Christian

⁹ P 346 v l.

¹ Gravière Cors Barbaresques pp 262, 369; below pp 478–80 as to family of the Doria.

commander posted these in front of his line to meet the enemy's charge, it being necessary to tow them out there by galleys for there was no wind.

■
ROUND-SHIPS ADOPT THE CLOSE-HAULED LINE AHEAD IN BATTLE.

Row-vessels formed for battle with bow toward the enemy and when they carried mechanical or gunpowder guns these were in the bow and the formation remained the same. Though in early mediæval days ships in the Ocean were not infrequently under sail they charged, grappled and resorted to the sword. The Battle of Sluys 1340 when Edward III of England defeated a French fleet is recounted by Froissart, and it is evident the ships were under sail when proceeding to the attack and the same is shown in a picture by this author of the action off Rochelle in 1371; when guns were used.²

We have then showing that by 1500 galleons and navires mixed and pure broadside ships, went into battle with row-ships, both depending largely on sails; and know also that by this date the masting of ships had become improved.³ Broadside guns had to be turned toward the enemy and because ships are on no point of sailing as manageable as when close-hauled the close-hauled single line became the line-of-battle; a cask dropped overboard by the van-ship can be picked up by any ship in the line. Such is the close-hauled head-and-stern line in which sailing-ships fought. It is heard of long before the day of Lepanto for we recognize it in 1500 in a battle between Arabs and Portuguese in the Far East. The Portuguese ships and Arabs as well had cartridges ready to put in the guns and formed close-hauled lines ahead.⁴ Again in 1503 we hear of it and in the same locality: ⁵ a Portuguese commander we are told by a contemporary writer, "Disposed his ships in such a manner they might be able to use all their guns at once." It is hardly necessary to add they were sailing-ships carrying guns on the broadside. Pantero Pantera cap-

² Johnes trans Froissart v 1 chap 49 for Sluys; the English had, "120 large vessels without counting others manned by 40000 men;" about 350 per ship: see pl 8 v of plates for picture of Rochelle battle, the ships are under sail all with one mast and one sail all huddled together, no gun appears: see above p 165 as to early use of sails by oar-vessels. Plate 15 Froissart is Crecy, 1346, where it is said guns were used, but men shown have cross-bows and long-bows and no gunpowder guns appear: the long-bowmen stand with arrows to be fired on the ground under their advanced foot. Froissart was born 1337.

³ Above p 309; below pp 645-46.

⁴ Voy Gama Hakl pp 368-9.

⁵ P 125 v 1 Hist Port Osorio trans Gibbs 2 vs 1752.

tain of galleys in the service of the Pope supplies in his *Armata Navale* written 1600 the only remaining information required: he says *nefs* should be separated by a distance equal to 3 or 4 times their beam; in other words by their length.⁶ It has been said the close-hauled line appeared when the Spanish Armada came to England in 1588 and no doubt it was used then for the ships were broadside and were nearly all sailing-vessels.

The oldest picture I know of showing gunpowder guns on the broadside is in Lindsay's *History of Shipping*.⁷ It is of a seal and though Lindsay does not fix its date it follows from what he says he must have believed it was not later than 1400: it represents a ship with 4 masts and one sail on each, broadside guns mounted in 2 lines and in port-holes, a gun pointing directly ahead and another directly astern. The next oldest picture I know of showing such guns is of an attack of Portuguese ships under Albuquerque on Aden in 1513: the ships show guns protruding from apertures in super-structures built on the main-deck near the stern, one ship shows a gun pointing straight astern; the defenders of Aden ply the assaulters with thrown stones portable cross-bows and standing throwing-machines of swinging-beam type. This picture was drawn by a contemporary artist and is from an engraving in the British Museum.⁸ Besides galleons intermediate between long- and round-ships there grew up a class called *galeasses*. Pantero Pantera wrote of these,⁹ "Galeasses are the largest vessels using oars and sails, they are long but narrow in proportion to their length. xx They have more oars than ordinary galleys and their oars are further separated from each other, they are longer by a third than ordinary galleys with more beam and higher by a third. The oars are much larger than a galley's, requiring at least 7 men to handle them. They have always 3 masts xx and thus 3 sails. Their rudder is *a la navaresque* that is to say rigged as in *naves*, and on each quarter is a great oar to help turn the ship.¹ The galeasse is heavy, of great mass, and

⁶ Arch Nav Jal v 2 p 273. This distance between ships was adhered to.

⁷ P 402 v 1.

⁸ See work cited n 4 p 459 above.

⁹ Jal Arch Nav p 395 v 1.

¹ This seaman says large vessels had in 1600 3 masts and one sail on each—huge fore-and-aft sails; while in the Ocean as far back as the day of Columbus, 100 years earlier, sails were generally square and 2 on each mast (except the after one). By a rudder rigged as in a nave is meant one centrally hinged as modern rudders are fitted; see word *alla navaresca* Jal's *Glos Naut* where is shown a seal of the city of Dam in Flanders of 1226 showing a rudder so fitted. The large oar on each quarter mentioned was to help the ship around when tacking; they could not have helped a large ship much and is impossible they could have been of much service.

turns and works heavily. Today they are so well designed and built at Venice though carrying more artillery than ever they work and tack² easily and without being towed almost like a light galley. At the prow and stern they have large places for soldiers and artillery. These are surrounded by *pavesades*, high solid permanent supplied with loop-holes through which the soldiers fire their muskets and arquebuses without being seen by the enemy. Just within the side of galeasses is a narrow gangway where the soldiers are conveniently disposed to fight and to repose. A second gangway from prow to poop divides them in two halves. They have one deck beneath which are a number of cabins and store-rooms. Galeasses are armed with about 70 cannons; the largest is on the central gangway, it has an iron ball of from 50 to 80 pounds; 2 smaller cannon are on each side of this one; 10 of various calibers—*demi-cannons* *demi-coulevrines moyennes* or *sacres*—are at the prow also. The poop has 8 guns of the same caliber as those at the prow. Also between each rower's-thwart from prow to poop the galeasse mounts a piece or *cannon-perriere* of 3 to 5 pound iron ball; these being short are very handy and may be easily manœuvred in the narrow space they are mounted in. On each side there are as many of these as of oars."

The pieces or cannon-pierriers using 3 to 5 pound iron balls placed between rower's-thwarts were in or near the level of the oars. The oars were pulled by 7 men who rose to their feet and threw themselves backward at each stroke, and tholes must have been 3 to 5 feet apart. The guns are short he says and easily manœuvred in the narrow space, 3 to 5 feet. There were 15 guns at the bow and 8 at the stern, and as there were 70 in all there were 47 between the rowers' benches. If we call this 50 there were 25 oars and guns and 175 oarsmen on each side. There were 14 men on each oar and its opposite and as a man needs 2½ feet in width, the beam of the ship was full 40 feet. The rowing-space was quite 150 feet long and since Pantero says the vessels were narrow in proportion to length we may put the last at not less than 300 feet. They were large and powerful ships discharging 15 shots ahead 8 astern and 25 on each broadside. The last used 4 to 5 inch balls and were short; of a class 200 years later called *carronades*. Their muzzle-velocity was not more than

² Jal's words are *evoluer* and *virer*. His remark about towing ships around and great oars to help turn them are very suggestive. Jibs were not used by large ships in these days; none of Ruyter's, 60 years later, have them; yet ships tacked in battle; the square sprit-sail of Ruyter's day was furled in battle; see above p 316.

400 to 500 feet but the havoc on the flimsy hull and closely crowded crew of a long-ship might be terrible. There is one question about the guns or rather two; did they hit and how often did they fire. It is generally assumed performance in these regards was indifferent, but we do not know this. Ship-captains knew it was necessary to hit; 3000 years earlier slingers could hit a hair; also, gun-fire was reserved until the enemy was near. As in battle today the first round was very important; broadside guns such as described could be fired 2 or 3 times a minute;—until they became too hot which would be very soon: they could continue to fire when ships were grappled.

THE DORIA, BARBAROSSAS AND DRAGUT.

Few seamen are more striking and interesting than the Doria and Barbarossa. The last and Andrea Doria were paramount in the Mediterranean in their day. Doria by galleys maintained ready to hire, held the balance of power in the West, and Barbarossa conquered realms in Africa, made nations of them and presented them to the Sultan at Constantinople asking for recompense only to go forth for more. The ships used cost the state nothing, being seized at sea and maintained by robbery. Such were the services of Andrea Doria to Genoa that a statue bearing the legend, "To the Father of His Country" was erected in that city, and so highly were those of the younger of the Barbarossas held that he was called by his countrymen *Khair-ed-din*, Benefactor of the Religion. Doria lived in princely fashion from hiring out ships, many oarsmen in which were prisoners taken in fight. Barbarossa, upon returning to Constantinople with his fleet on a certain occasion,³ "Was received as a great man of the sea. Solyman the Magnificent received him with joy when he presented many boy and girl slaves; it is said there were 200 women and young girls each carrying in her hand a rich vessel of silver and gold. There were brought into the city 100 camels loaded with silks and cloths of gold many rich curiosities and a thousand other things of ostentation; thus the city of Constantinople had much to see and admire. He had lions and other animals silks and rich clothing and told willingly the story of his wars, especially in Barbary Italy Spain as well as of the sea." The Sultan made Barbarossa Admiral of the Sea in 1534 because,⁴ "There was

³ Sandoval cited n 5 p 471 above v 2 p 189.

⁴ Sandoval v 2 p 188.

no better corsair nor one so powerful on the sea nor could any other captain be put before Doria."

Dragut whose death at the siege of Malta has been mentioned was much with Barbarossa and was treated as a brother Sandoval says. He was once trapped behind the Island of Jerba 150 miles west of Tripoli on the Barbary coast by a fleet under Doria. Doria deemed his force too small to attack in the narrow and shallow canal, and closing all exits sent for reinforcements and siege material; upon which Dragut hauled his ships overland 5 or 10 miles and escaped; they could not have been less than 150 feet long and 25 feet beam. Such exploits were not uncommon: the last hope of the Greek garrison in Constantinople in 1453 was gone when the Turks hauled ships overland north of Galata into the Golden Horn, and Venetian ships, some of large size, were hauled over mountains by the Venetians in 1439 into Lake Garda.⁵

Dragut ventured too much once: he anchored his fleet in a harbor in Corsica; "Many of his crews were onshore dividing clothing and captives they had taken and great quantity of silver and jewels from the churches. Suddenly he saw ships at the mouth of the harbor flying the Imperial banners; he sounded the call to join the galleys xx but the enemy's guns began to play so that not only those onshore dared not join the ships but many onboard threw themselves into the water flying to the land; some 600 escaping to the mountains. Dragut and others fought bravely but were taken and with many others put at the oar. xx After this most successful enterprise Joannetino returned and presented Dragut to his uncle the Prince Andrea Doria who received him with very great contentment. Barbarossa tried to ransom Dragut and at the end of 4 years, Andrea Doria consented to this. xx When Dragut was freed he received from Barbarossa a galley provided with guns arms Christian oarsmen fighting men and a patent making him General of all corsairs both Moors and Turks upon the Sea. xx In 4 years he had robbed enough to equip a fleet of 14 vessels, xx to which he joined other Turkish corsairs making a fleet of 26. xx He now no longer cared for Barbarossa or his complaints. He married the daughter of a Turk of Modon named Saraybat, received from her a great dowry and a great house in which he kept slaves for 5 galleys on the coast of the sea 12 miles from Guadezuil where Zala the Lord of

⁵ See as to Dragut's exploit Brantome Œuvres Compl v 2 p 56; Daru Hist Rep de Ven v 3 p 64 as to Ven ships. Daru says 2000 men were employed, 200 to 300 oxen being required for each ship. Brantom was co-temporary.

Gelves had his house. From there he went forth with his armada to rob the coasts and sea of the Christians.”⁶ Dragut was killed during the siege of Malta 1565.

Barbarossa died 1544. Sandoval says he returned in that year to Constantinople from the south of Italy with plunder and captives and died the same year,⁷ “He caught a fever and died being more than 80 years of age. He was red as he had the name xx very cruel more so than any other corsair of his day. xx He was brave and forward in fight, fertile in expedient, enduring at all times, constant in the reverses of fortune, never shrinking or showing fear. He died exceedingly rich in his house in Pera leaving his son Hazam Barbarossa at the moment in Algiers his heir.”

Very different from the lives of the Barbarossas and Dragut was that of Andrea Doria. The first came in at the hawse-pipe as sailors say Doria at the stern. The Barbarossas and Dragut were poor boys and went to sea for a living; Dragut and the most famous of the Barbarossas were taken prisoners and chained to the oar, Barbarossa escaping in the confusion when his ship was in danger and Dragut being bought from the oar by Barbarossa. The Doria had been powerful for centuries before the time of Andrea Doria and had married into royal houses.⁸ Andrea was born 1466 and died 1560 having followed the sea until 90 and his rival Barbarossa was in service until 80. The principal services at sea of the Doria family were as follows: *Uberto*; commanded the Genoese fleet when it won the 2d Battle of Meloria 1284; in the fleet was Lampa a younger brother with 6 sons. It is said there were 250 Dorias in the battle; large part of them onboard a galley called St Matthew.⁹

Tediséo; one of Lampa’s sons at Meloria; in 1291 he passed into the Ocean at Gibraltar with Vivaldi to go to India by sea and was heard of no more.

Lampa; commanded at Curzola 1298 winning from the Venetians: his eldest son was slain onboard his father’s galley; “Lampa engaged in fight with the Venetians,” says the chronicle,¹ “Was standing on the poop

⁶ Sandoval v 2 p 665. The events occurred about 50 years before S wrote.

⁷ V 2 p 516.

⁸ See Doria et Barberousse Gravière; Andre Doria a Condottieri Admiral E Petit; Deux Pirates au 16 ieme Siecle Farine; Blackwood’s Magazine vol 52 1842 no 8 Chaps of Turkish Hist.

⁹ A list of their names has been published: see Intro Cordier’s Yule’s M Polo p 56 note for where this may be found.

¹ Cord Yule’s Polo Intro p 48 note.

of his galley, his son fighting valiantly on the forecastle was shot by an arrow in the breast and fell wounded to death; xx whereat his comrades were sorely shaken and fear came upon the whole ship's company. But Lampa hot with the spirit of battle xx ran forward to the spot and ordered his son's body to be cast into the deep telling them for their comfort that the land could never have afforded his boy a nobler tomb. Then renewing the fight more fiercely than ever he achieved the victory."

Paganino; commanded in a battle with the Venetians within sight of Constantinople in 1352; Nicholas Pisani commanded the Venetians: the fighting was continued through a stormy night, February 13, both fleets being much damaged. This war went on the Doria being in it; the year following the action mentioned fleets met near the north of Sardinia: the Genoese galleys except a few posted on each wing were *bound together with chains* and the Venetian fleet *included 3 round-ships* each with 400 Catalan *cross-bowmen onboard*: the Genoese were worsted. The year after, 1354, fleets met under circumstances as follows: Pisani with Venetian ships had gone to Porto-Longo in the Island of Sapienza southwest of Greece and near the Bay of Navarino, afterward the place of another battle. Pisani was refitting and thinking his whereabouts unknown had hauled his ships out of the water, a thing necessary at times in the day. When thus incapacitated and the crews living onshore probably Doria entered the harbor and captured 35 of 37 ships.

Lucien; killed while in command in an action in sight of Pola in 1379; was succeeded by his brother *Ambrose*. This is the War of Chioggia. Victor Pisani, not Nicholas of whom we have just heard, commanded the Venetians who were defeated; because of this though the ships were only half equipped and the crews inferior Pisani was thrown into a dungeon and declared incapable of holding office for 5 years: but as the fleets of Genoa closed around Venice threatening destruction the clamor to put Pisani in command became so insistent that this was done; and while he was in command the Genoese were brought to a stand. Another celebrated person appears at this time; Carlo Zeno of the family that probably came to America about 1370.²

² Above p 277. The manners of the day are shown by Marion Crawford in his novel *Arethusa*: in a slave-pen in Constantinople Zeno buys *Arethusa* to carry to a friend in Venice and has her brought to his house until ready to go to Venice. They fall in love she saves his life and turns out to be a young noble-woman of Venice: they are married and he returns to the Adriatic in time to succor Pisani's fleet sore beset by the Genoese and need to keep the sea during the winter.

Pierre; commanded in the War of Chioggia; was besieged by Victor Pisani and killed by a cannon-shot in the defences he built to keep the Venetians out of the lagoon where he had moored his ships.

Andrea; the Prince Doria of whom we have heard; commanded the Christian fleet at Previsa.³

Andrea-Jean; commanded the right wing of the Christian fleet at Lepanto.⁴

CARLO ZENO AND HIS REPORT OF AN ACTION IN 1403.

Crawford's story of Arethusa and Carlo Zeno is a picture of the ways of the day and we have besides authentic history regarding Zeno. He was in the East with a fleet in the early part of the War of Chioggia, 1378-1381, and word was sent him to return. Victor Pisani commanded the Venetian fleet in the Adriatic at grips with the fleet of Genoa; he had difficulty in inducing his crews to keep the sea in the winter of 1379-80 and promised he would take them in if Zeno's fleet did not come by January 1. Fortunately it came and the men from his ships erected onshore batteries of gunpowder guns by which to destroy the Genoese fleet: this is usually said to be the earliest use of guns on considerable scale, though they were in use 150 years earlier.⁵

A galley was not a luxurious abode especially in winter and battles in them were bloody affairs. Yet men went to sea until old; we have seen that Andrea Doria followed the sea until 90 and Barbarossa until 80⁶ and Carlo Zeno was active until 1418 when 80 years old.⁷ In 1402 being 65 he commanded a fleet at Sapienza, where as we have seen the Venetians under Pisani met crushing disaster 50 years before, and we have Zeno's report to the Doge; the oldest that has survived though there are statements showing it was customary for admirals to write reports 15 centuries earlier⁸ and Nicias reported operations of the Athenian fleet in Syracuse harbor in 415 B C.

Zeno's fleet was off the harbor of Sapienza the Genoese anchored in it. The last put to sea and after some hesitation the fleets engaged, for Venice and Genoa had shortly before been allied in resisting Turkish advance on Constantinople: each consisted of 11 galleys apparently. Zeno reports,⁹

³ Above p 472.

⁴ Below pp 504 and foll'g.

⁵ Above pp 440, 443.

⁶ Above p 478.

⁷ Daru Hist Venice v 2 p 348.

⁸ Above p 83 n 2. The other battle at Sapienza is above p 479.

⁹ Daru Hist p 292 v 2.

"I gave the signal and *forced sails and oars* to attack. The battle was joined very vigorously and lasted with great loss on the 2 sides for 4 hours but God and the protection of St Mark gave us the victory. The enemy was forced to fly with 8 galleys leaving 3 in our power. If all had done their duty none would have escaped. If God permits me to return to Venice I shall beg Your Seignoury to order an examination of those whose conduct saved the enemy. My ship was attacked by the enemy's flag-ship onboard which were nearly 300 men xx. For more than an hour I had to defend my flag-ship against this galley and 2 others. The enemy boarded and we fought hand to hand on our own deck but were able to repel them. A single one of our galleys that of Leonardo Mocenigo came to our succor and disengaged us charging the enemy with much vigor. The Genoese flag-ship was beaten and retired hardly able to use 20 oars. If she had been pursued she would have fallen into our hands but my signals were not obeyed and I could not myself undertake the chase not having onboard 30 men fit to fight xx." Zeno was himself wounded.

VOYAGES OF LONG-SHIPS TO DISTANT PLACES: FINDING POSITION.

We now go to about 1250 to notice voyages of long-ships, necessarily broken by landings, and examine what supply there was of means for finding position; charts compasses astrolabes tables giving position of heavenly bodies. The ship in which St Louis went to Tunis in 1270 had a chart on which the master pricked position for the King when at sea and out of sight of land, and in the inventory of articles in a ship captured in 1294 we find 2 charts and appliances of the captain for writing.¹ Alfonso the Wise 1252-1284 requires ships shall carry, "Learned persons to aid in guiding the ship" so that they may proceed, "Most directly" to the place they wish to reach; that ships, "Shall make great voyages across the sea;" and states the captains, "By their brains guide ships across the sea" and, "Know all the methods of the sea."²

The King of Aragon about 1350 directed ships shall be provided with 2 charts and other appliances.³ Nor were matters purely scientific overlooked. The part Raymond Lull took about 1250 has been

¹ Above p 321 as to charts in a ship in 1294 and p 428 in one in 1270.

² *Siete Partidas* Madrid 1807 3 vs; v 2 p 261; v 3 p 236: Navarrete *Diss sobre Hist Nautica* p 45.

³ Capmany *Ord Arm Nav Corona Aragon* 1354 Madrid 1787: cast guns gun-carriages gunpowder cannon balls of iron and stone, *ballestas* (portable cross-bows), 3 compasses to each ship *arquebuses* (portable gunpowder guns) muskets, 2 "tillers with wheels" to each ship, sand-glasses and other articles are required to be carried. Here is early mention of a *wheel* in connection with the tiller.

alluded to ⁴ and King Martin of Aragon who died 1410 left a library comprising 600 volumes, among which were works called *The Book of the Navigating Chart*, *Of ships*, *The Book of Ordinances of the Sea*. Pedro Nino who went to sea about 1400 mentions in his *Cronica* compasses charts pricking position on the chart sand-glasses sailing in the outer Ocean for 5 days and sounding in 70 fathoms and bringing up stones and pebbles on the lead, etc.⁵ But though we know all navigational instruments except chronometers existed before 1250 the men who wrote the records which have been preserved say little of them: once in a while when as with the chart in a ship in 1270 and the 2 in the inventory of 1294 some reason leads to it we find an article mentioned. The men who wrote knew nothing of finding the way of a ship in the midst of the sea, to repeat the phrase in the *Book of Proverbs*, and said nothing of it. Very likely pilots were willing to hold their tongue for craftsmen have ever secreted art. Only when tales and legends were written on maps by the seamen can we penetrate the mystery.

Yet before history and geography began ships went far, coasting at first and anchoring at night. Also before history and geography began appliances with which pilots could help themselves were in existence. The pilots were often learned men; the captains of 1294 alluded to above carried writing materials in their belt and Alfonso the Wise lays it down that learned persons capable of directing ships shall go in them. When not long after 1400 the first of the stories of men in the ships comes to us their art is full-armed, but no-one can believe it developed suddenly. In 1250 there were good charts made from positions determined by ships, many of them Arabian: a modern author writes,⁶ "Arab charts of the 13th century are known xx which furnish much more exact information of northern places than any co-temporary Latin Map."

LIST BEGINNING 1315 OF SHIPS VENICE SENT TO FLANDERS.

There is preserved a list of galleys trading to Flanders from Venice from 1315 on and Jal quotes a description of the voyage. The date of the writer to whom we owe these details was about 1400. Our early authority says on this voyage ships run 3 to 4 thousand miles and are gone 18 months to 2 years and gives places they stop: following the coast of

⁴ P 322 above.

⁵ Above p 322.

⁶ Hamy *Etudes Hist et Geog* Paris 1896 p 31.

Italy they went to Genoa Nice Marseilles Barcelona Malaga; "When in the Strait of Gibraltar to reach Flanders they turn to the right to go north and follow the land until they come between England and Flanders in a strait which is not wide."⁷ In the voyage cargo was carried between intermediate ports. There is the following record belonging in about 1500 as to galleys used for long voyages,⁸ "Some large galleys which had been unused for several years were fitted: these are very large made like *nefs-of-burden* and for the same purpose but different because by ingenious arrangement they proceed not under sail only but by oars as well like *galeres subtiles*. The Venetians use them in maritime traffic with the most distant nations."

Another author of same date says, "A number of young gentlemen of noble families go in these large galleys as well to practice themselves in the naval art as in commerce:" Jal gives extract from a co-temporary author showing what these last were like;⁹ "These galleys had a total length of 135 to 140 Venetian feet 23 feet was their greatest breadth and depth 8 feet. In the hold they had 13 feet beam and 31 feet from *apostis* to the opposite.¹ They had 35 oars 35 feet long shipped from bow to amidships: from this point to the stern there were no oars the space being for the use of merchants. Each oar had 4 men. These galleys had 3 masts; xx the mast at the bow had a square sail the others lateen sails. The crews were composed of 86 men and they carried 2 *falcons* of 6- and 12-pounds or 14 *perriers* of 14." Having only 35 oars in all these were slow under oars; like all galleys they stopped often. Note that because of use of aposti oars are the same length.

JAMES I OF ARAGON SENDS AN EXPEDITION TO THE BALEARIC ISLANDS.

James I King of Aragon 1218-76 surnamed the Conqueror left a Chronicle believed to have been written by himself. The Moors held the east of Spain from the south as far as the Ebro and the King determined

⁷ Jal Arch Nav v 1 p 385 note. The distance Venice to Flanders from one headland to next is 3000 miles; going the way these vessels went it is 4500. See Rømer's *Fædora Hardy* 1869 for Eng statutes as to sea-commerce 1066-1654. V 3 is index and most entries are about ships.

⁸ P and v Jal cited note next above; note.

⁹ P 387 v cited note next preceding. Many mediæval writings are not found in this country and authors who repeat these often leave out parts concerning ships as of interest to few.

¹ The *apostis* was a beam laid along each side of a vessel and outside her on which the oars shipped; see pictures pp 78, 80, 514, and legends on these.

to drive them from the Balearic Islands, which lie east of Valencia 90 miles and S E by S 140 miles from Tarragona, the southern-most city of consequence in Christian Spain of the day. The King to learn about the Balearics dined with En Pere Martel a citizen of Barcelona who had great knowledge of the sea. Martel was a shipmaster² and when asked about Mallorea said he would give account of it as he had been there once or twice. As the tale goes on it is manifest the rich merchants, *prohomens*, of Barcelona are to furnish the ships; very likely the King had none.

It being decided to attack Mallorea ships are ordered to be at Salou by May 1. The King went there at that time but the fleet was not complete until the beginning of September and did not sail until then. "There were in all," the King writes,³ "150 large vessels besides small barques xx. Before starting I ordered how the fleet should go; first the ship of En Bouet xx and carry a lantern, that of En Carros take the rear-guard and carry another lantern. The galleys should go around the fleet so that an enemy galley xx should first encounter our galleys. I started with a land breeze."⁴ When the King's ship was 20 miles at sea the wind changed; "The *comitre* of my galley came to me with the sailors," the Chronicle says,⁵ "And said xx the S W wind is so against you you cannot make the island of Mallorca with it;⁶ by our advice you will put about and go back to land." The King would not do this: the narrative goes on, "In the first hours of the night I overtook the ship of En Guillen de Moneada who had the lead xx, so though I sailed last from Salou xx my galley was in the morning of the next day before all the other ships. We went with the S W wind, my galley I and all the rest as close-hauled to the wind as we could; so we ran all night before the fleet without shifting or shortening sail as fast as my galley could run. Between nones and vespers⁷ as the wind rose and the sea became higher, so high was it a third of my galley forward went under-water when the heavy

² Chron James I King of Aragon xx Written by Himself trans Forster 1883 p 98 v 1: shipmaster in the original is *comitre*.

³ P 112 v 1.

⁴ Salou the point of departure is a little south of Terragona and thus not far from the southern end of Christian Spain. From Salou the west headland of Mallorea near Palma bears SEbS 140 miles. It will be noted the fleet sailed without stated formation but expeditionary forces have often done this. The land breeze at sailing must have been about N W and the fleet started about night-fall.

⁵ P cited note 2d above: the sailors would not come now.

⁶ The bearing Salou to Mallorea is SEbS; with the wind S W the course was 7 points from the wind. This wind where the ships were would soon get up a sea.

⁷ Between 3 in the afternoon and sun-down: see picture p 487 of galley in a seaway.

waves of the sea came upon her. Towards vespers before sunset the wind abated and we saw in the distance the island of Mallorea."

The story holds out well: the ships sailed about dark; when 10 to 20 miles from Salou a S W wind came up, probably light at first and then stronger and died down at sunset next day. Mallorca can be seen about 20 miles, so as the whole distance from Salou is 140 miles; the ships made 120 miles in 20 hours with a scant wind and head sea, plunging into the sea at every jump. It was a well-ordered and executed expedition, made so by the King's determination to go on. "By midnight," the Chronicle continues, "I could see and count 30 to 40 ships galleys and transports." The date of arrival was September 7, 1229.

There is little more in King James' Chronicle. The islands were taken and have been held by Christians since. Throwing-machines were used in operations ashore and to show ships were more habitable than in early days, when the King is in the islands living ashore, "The foot-soldiers and sailors came early in the morning from the ships and returned at night xx; all day they were with me and at night they went back to the ships."⁸ When the King at subsequent date sails for the Holy Land and is driven back he writes, "All the time that the storm lasted full 3 days and nights I never ceased whenever I could be private and alone in the place where I slept which aboard ship is called Paradise praying xx for a fair wind."⁹

RAMON MUNTANER.

Ramon Muntaner wrote a Chronicle about the same time and place as James the Conqueror. He began in 1325; his book begins with the birth of James in 1208 tells of the expedition to Mallorca and ends in 1328. Muntaner being at his farm near Valencia and asleep in bed an old notable dressed in white came to him and bade him get up and prepare to make a book of the great marvels he had seen God work in the Wars he had been in. He writes much of Roger de Luria the great admiral of the day who was co-temporary, for Luria died 1305 and Muntaner about 1328 when his Chronicle ends.¹ En Roger de Luria was Muntaner says,² "Of

⁸ P 141 v l.

⁹ P 606. Markham Majorea and Minorca 1908 gives history of the Balearics.

¹ The date for Luria's death is from Du Sein Hist de Mar v 2 p 179 note: the admiral is buried at Barcelona.

² Chron Ramon Muntaner Hakl v 1 p 47. There is a French trans by Buchon being vs 5 and 6 in Coll Chron Nat Francaises. Our Congress Lib has Muntaner in Catalan. See also p 324 above as to Muntaner.

noble descent from banner lords" and grew up at court; "His barony was in Calabria and consisted of 24 castles in one district and the principal castle called Loria xx. He became a perfect Catalan and spoke the most beautiful Catalan." Muntaner tells of battles with Saracen fleets about 1250: in one of these the Christian vessels—only 4, "With great strokes of the rowers advanced toward the Saracens xx. The Saracen admiral ordered the trumpets and nakers to be sounded and with great shouts began a vehement attack. And the 4 galleys most beautifully and without shouts and words and any clamor went to the attack in the midst of the 10 galleys xx; it lasted from the morning until the hour of vespers and no-one dared to eat or drink." The 4 Christian galleys captured the 10 Saracen we are told and took them into harbor. The Christian admiral previous to battle made his men a speech in which he said, "*Roped together* as we are we must attack resolutely."

Fighting in the Mediterranean was caused by the brother of St Louis of France making himself King of Naples and Sicily in 1266 driving out the Norman princes who had ruled there for 2 centuries; the massacre of the French in the Sicilian Vespers following in 1282. In 1283 the King made Luria Admiral of Catalonia the Kingdom of Valencia Sicily and All Territories He Possessed and That God Might Grant Him to Conquer and sent him to sea with a fleet of 25 galleys, "Each with a Catalan *comitre* 1 Latin and 4 Catalan steersmen and the same proportions among the sailors in the fore-part of the ship; the rowers to be all Latins and the cross-bow men all Catalans. xx So let the standard be raised by the table at once and arranged to pay these 25 galleys and 2 *lenys* for 4 months for we wish to pass to Catalonia in them."³ The King was at the time in Messina, 725 miles by the shortest route, that around the south of Sardinia, from Barcelona, and 1025 by that along the shore of Africa to Algiers and thence north. The longest sea-stretch in the last is from Africa to the little island of Cabrera south of Mallorca 160 miles. The King took ship for Barcelona at Trapani in Sicily as we shall presently see and thence followed the north coast of Africa to Algiers, sailing in all 1025 miles and making one longest stretch at sea of 160 miles: if he had gone south of Sardinia and north of Minorca he would have shortened the voyage 300 miles but by this way there are runs of 230 and 250 miles at sea. The longer way was taken as involving only one sea-run of 160 miles: such were the ways of long-ships.

³ P 173 v 1 Muntaner Hakl.



A print of two round-ships and a row-galley in a squall: it is by W. Hollar, long resident in Holland and much at sea: King James says his galley plunged her bow into every sea, p 487.



This is by Hollar, a resident of Holland who was much at sea about 1650. The opening in the stern should be noted; it is shown in many of Hollar's ships: it comes at upper end of rudder which in later ships was within the ship and its purpose must have been to allow movement of the tiller.

Following the above Muntaner recounts the King ordered Luria to send 4 galleys from Messina to Trapani every man in them to be a Catalan; from Trapani he will go to Barcelona. He says he will be at Trapani in a fortnight, "Reckoning up to him the daily march he intended to make."⁴ The 4 galleys were at Trapani on time; the King went in one to the Barbary coast along this as far as Collo then to Cabrera, the little island near Mallorca to the south, then Mallorca Ibiza Cullera, the last a town in Valencia below the city of that name. They were very careful of the King. The only thing of interest during the voyage is that at Collo a town half-way between Bona and Bougie the King wished to communicate with people onshore: Muntaner writes, "The galleys were at anchor in the roads with their banners hoisted and the King in person went onboard a leny⁵ and said, 'Let us approach the shore and hang out the shields I wish to speak with them.' xx The rowers of the leny began to row and when within a cross-bow shot the King sent onshore a seaman who knew the Saracen language well to tell them to give his leny a safe-conduct. xx When they had the safe-conduct the leny approached the land and 4 Saracen knights on horseback went into the sea as far as her stern and went onboard.⁶ And the Lord King made them sit down before him and gave them to eat and asked for news xx."⁷

It is necessary to realize that voyages were made in one way by galleys and another by round-ships. The present voyage is a remarkable case being made by King Peter 3d of the name and reigning in Aragon 1276-1285. In less than a year his Queen with 2 sons went in the reverse direction Barcelona to Sicily in a round-ship without touching⁸ being sent to rule Sicily until the King can himself go there. Galleys were uncomfortable and wet at sea and we can only presume a high wall-sided *nao* was better for the Queen than a galley, interesting and full of incident as voyages in the latter were. A *nao* might reel off the 750 miles between Barcelona and Sicily in 3 to 5 days and was not likely to be more than 10 while a galley would hardly run the 1050 miles she had to make considering

⁴ Trapani is in the extreme west of Sicily; 165 miles by land and 200 by sea from Messina. If the King reckoned without something to cipher on he was good at figures: 14 days at 12 miles would put him at Trapani.

⁵ Smaller than a galley; the trans p 50 note says, "The meaning of *leny* elsewhere called *fuste* is literally wood."

⁶ The stern was in 4 to 5 feet of water the bow in deeper water; when vessels were brought to the land in enemy's countries their bows were seaward.

⁷ P 197 Muntaner.

⁸ Below pp 491 and foll'g: see picture here.

the temptation to land and loiter in less than 30. It was perhaps the fashion for men to go by long- and women by round-ships as men rode horses and women and monks mules. King Peter never returned to Sicily dying Nov 1285. When the King lay dying a galley was ready for sea at Barcelona and sailed on his death for Mallorca where Alfonso the eldest son reigned, now Alfonso III of Aragon; onboard was a wise and good knight and 2 copies of King Peter's will. The galley within a few days was at Mallorca where the knight visited Don Alfonso; thence she steered for Sicily and the Queen and her son the Lord En Jaime, who had been created King of Sicily before King Peter's death, were informed.⁹ Thus Catalonia had in 1285 two subsidiary kingdoms Mallorca and Sicily won by her ships in 50 years.

When the King took 4 galleys and went from Sicily to Catalonia Luria had 18 and the French equipped against him at Marseilles 25: "En G Cornut of the honorable men of Marseilles and of an ancient family," Muntaner says,¹ "set up a recruiting table to man 25 galleys with men of good birth all of Marseilles and of the coast of Provence xx and that he should see that every man was as brave as a lion and he himself would be Commander and Chief Lord. And that he should go at once towards Sicily and visit the castle of Malta there refresh his men and seek En Roger who had not more than 18 galleys. xx 'Do not on any account let them escape you and do not appear before Us until you have killed or taken all' said the King; upon this En Cornut rose and went to kiss King Charles' feet." Cornut proceeded to Naples and sent 3 galleys to find Luria. Luria captured these and, "Went immediately to Messina and took the 3 galleys with him stern foremost and pendants trailing."² Luria and Cornut have fleets at Messina and Malta, 250 miles apart. On the day after reaching Messina Luria sailed with 21 galleys and 2 lenys for Malta. The first day he went as far as Syracuse 120 miles³ and here obtained news that the enemy's fleet was at Malta: Muntaner says, "The Admiral left Syracuse at once and went as far as Cape Passaro

⁹ Muntaner pp 368-72; no other details are given. It was important to be first with the news; a galley was sent and we are told she arrived soon. How many were her rowers how often and long she stopped there is no means of knowing.

¹ P 185.

² Muntaner p 188. Buchon translates chap 82, "Towing the 3 *galeres poupe en tete et pavillons trainants*:" I do not think this way of towing captured ships could have been much practiced: see however below p 507 for mention of it after Lepanto.

³ I can recall no better statement of the run of a fleet of long-ships: of course it was principally with sails. It must mean 120 miles in 24 hours.

that day and there rested for the night. And when he had rested for the night and the day was near coasting along the shore he went as far as Cape Ras-Altara xx and when he came to Fuente de Scicli he made everyone land and in the farm of Scicli and at the castle they had great refreshment. Thus he made every man refresh and adjust himself and examine his arms and the cross-bow men the cords and nuts of their cross-bows and all that was wanted."

From Syracuse to Cape Passaro is 40 miles and if the ships kept on to the latter place after doing 120 from Messina in a day, which is what Muntaner says,⁴ they did a hard day's work, even if they sailed most of the time. At Passaro they remained the night and in the morning followed the south coast of Sicily westward to Scicli, 30 miles west from Cape Passaro and 50 north from Malta. What is translated *nuts* of cross-bows should perhaps be winches, for cross-bows had winches or ratchet-movements to cock them, the bows being too strong to be bent by hand.

"That afternoon," Muntaner goes on, "They had great refreshment of meat and bread and wine and fruit for this Scicli is one of the most fertile places in Sicily and they all carried away water⁵ which is of the most wholesome of the world. When all had supper and had provided themselves with water the Admiral preached to them and spoke many very good and timely words saying in particular, 'Barons before it is daylight I shall be in the part of Malta where I shall find 22 galleys and 2 lenys manned by men of Provence xx.' And at once they all answered the Admiral, 'Let us go for assuredly they are ours xx;' and all began to shout *Aur, Aur*. They embarked at once taking with them a barge of 8 oars they had found at Scicli to reconnoiter the port secretly by it. When embarked they put out to sea with a land breeze⁶ and before the hour of matins they were before the port and went on with muffled oars."

"The men of Provence had their 2 lenys on guard at each of the points at the entrance to the harbor but the barge entered through the middle with muffled oars. xx They found all the galleys had their oars unshipped and counting them found there were 22 galleys and 2 lenys;

⁴ P 189.

⁵ Nowhere else in the story of row-ships is it said the men provided water; yet they must have done this always. Drinking cups are mentioned by ancient authors; above n 8 p 116.

⁶ Buchon's trans has this chap 83, "During a storm that took place on the land." The fleet had 50 miles to go to Malta, it was summer and darkness did not last more than 8 hours; to be at Malta by daybreak they must make 6 knots.

these 2 being at the look-out post had also their oars unshipped. So the barge went out of the port went to the Admiral and told him what they had seen. The Admiral made his followers put on their armor and put the galleys in order for battle. When all were ready for battle day was beginning to dawn and all cried to the Admiral, 'Let us attack for they are ours.' Then the Admiral did a thing which should be counted to him more for madness than sense; he said God forbid he should attack them in their sleep, rather did he wish the trumpets and nakers to be sounded; and they began to enter the harbor formed in line and all galleys *lashed together*. The Provençals awoke at the evil sound and at once the Admiral En Roger raising the oars let them put on armor and get ready xx. Then the Provençal's trumpets sounded xx and well prepared and in order-of-battle they came towards the galleys of En Roger de Luria and the galleys of En Roger came towards his. In the middle of the harbor they came to the attack so vigorously that the prow of every galley *was shattered*⁷ and the battle was most cruel and fierce. xx The battle began at sunrise and lasted until the hour of vespers xx and although the men of Marseilles had the advantage of one galley more xx when the hour of vespers came full 3500 of them were killed so that those who remained on deck were of little account xx. And all gathered fresh strength and boarded the galleys of the Provençals and all they found on deck were killed; not 500 men came out alive xx. So they took the 22 armed galleys and one of the armed lenys; the other escaped out to sea for it had many more oars than those of En Roger. It went to Naples and Marseilles and when King Charles heard he held his cause for lost."

"When the Admiral En Roger had taken the galleys and leny he went to the western part of the port and landed his men and each man looked for his companion; they had lost full 300 and of wounded there were 200 of whom the greater number recovered. xx He sent the armed barge to Syracuse and a letter requiring runners be sent to Messina and throughout the island of Sicily to recount the good news. And the Admiral manned the armed leny he had taken from the Provençals and sent it to Catalonia to the Lord King and Queen. It went by Mallorca and came

⁷ Buchon trans chap 83 has, "*Toutes les proues furent brisées.*" This and Herodotus' statement older by 2000 years that beaks of ramming ships were bent and twisted (above p 112) are the only mentions of harm to ships by ramming I can recall. In this later case the ships went on fighting until sundown and the ships Herodotus wrote of went on about their business; probably ram-blows were seldom right, a ship seldom struck end-on.

to Barcelona⁸ and from Barcelona they sent a runner to the Lord King and to my Lady the Queen to the Infantes and throughout the territories of the Lord King of Aragon."

The Hakluyt translation of Muntaner says Luria's ships were lashed together and Buchon renders it,⁹ "*Attachees* the one to the other in order of battle." It is difficult to believe it was worth while to sacrifice mobility thus but there can be no doubt ships were often if not always lashed together for battle, possibly sometimes only a rope between them to limit the enemy's assaults to the bows. The Northmen lashed ships together, it was practiced in modern day in far-away Hawaii,¹ Alfonso the Wise requires his ships to be provided with, "*Chains to hold the ships together to prevent them from flying*,"² and by a Catalan ordenanza of about 1350 ships must be provided with, "*Bars with chains to iron ships together so they cannot fly*."³ It is all at variance with the elegance of the ways written of by Greek authors. We have also the words of an admiral exhorting his ships going into battle, "Roped together as we are we must attack resolutely."⁴ The first mention of this is in case of Roman ships about 200 B C.⁵

THE QUEEN OF ARAGON GOES IN A ROUND-SHIP DIRECTLY FROM BARCELONA
TO SICILY: HER SHIP CARRIES COMPASSES AND ASTROLABES.

By Luria's success in Malta Aragon obtained possession of Sicily and the Queen and her sons were sent to take possession the year after the battle. Muntaner says,⁶ "The Lord King xx told them to fit the ship called La Buenaventura and another the largest in Barcelona after that one, to cover them with hides and put into each 200 fighting men, to put in *bucons* anchors and *arganels*,"⁷ xx and to put in all that is wanted for

⁸ This must mean the way King Peter did not go; see above pp 486-8.

⁹ Chap 83.

¹ Above p 392 two sagas and p 171 respectively.

² *Siete Partidas*; Real Acad Hist Madrid 1807 v 2 p 265.

³ Capmany Mem Mar Barcelona v 3 p 59.

⁴ Above p 486.

⁵ Above p 170.

⁶ P 229; see above pp 487-8.

⁷ The words *bucons* and *arganels* are in Muntaner's Catalan and the translator Lady Goodenough has notes to them; etymologists she says connect *bucon* with *bruscula* or *brujula* which is modern Spanish for compass. *Arganel* is given by modern Span dict as the name of the ring by which an anchor or astrolabe is held suspended. The date is 1283, and there is no doubt the ship carried compasses for we have earlier mentions of them in ships; below pp 265 and foll'g: also there is reason to believe she carried astrolabes since these were extant many centuries earlier; above pp 238-44.

armed ships, and to fit out 4 galleys and 2 lenys and 2 barges to sail all together; for he wished to send my Lady the Queen to Sicily and the Infante En Jaime and the Infante Fadrique with her. And besides the mariners 500 well-equipped cross-bow men and 500 retainers in order that the ships and galleys be well fitted-out that they reinforce the island of Sicily."

"When all was fitted-out and apparelled my Lady the Queen and the Infantes arrived and a great feast was made for them. The Lord King commanded to embark xx and when all were embarked my Lady the Queen took leave of the Lord King in his chamber xx and when my Lady the Queen had taken leave both Infantes entered xx and threw themselves at his feet and the Lord King gave them his grace and his blessing and kissed them on the mouth and spoke many good words. The Infante En Jaime always was and still is full 7 years older than the Infante En Fadrique xx; one can say of him the proverb of Catalonia that the thorn which has to prick is pointed from the beginning. xx When all leave-taking was over and my Lady the Queen had completed her orisons the horses were got ready and they went to the sea. The King of Mallorca ^a on horseback led the Queen's horse by the bridle and it was also thus led by xx and by other rich homens xx more than 50 who were on foot around her, as well as by the consuls of Barcelona and many other citizens. xx When they came to the sea the Lord King of Mallorca dismounted and lifted my Lady the Queen from her horse and then put her and with her the Infantes into the beautiful skiff of the ship xx. They began to row and my Lady Queen turned and made the sign of the Cross and blessed her sons and then all the people and also all the country. And the mariners rowed and they went to the biggest ship, the Buenaventura. xx The ship was on the point of sailing, the men on the yards⁸ and the steersman ready to salute, and when he had saluted he gave the order to set sail and at once the ship sailed away and all the other vessels."

"When the galleys and ships and lenys had sailed that Lord Who guided the 3 kings and sent them the star by which they directed themselves also sent to these 3 persons the star of His grace namely to my Lady the Queen and to the Infantes; xx as God wished to guide those 3

^a The Queen's son.

⁸ Buchon's trans ch 95 has, "The sails were hoisted the ship left xx." One learned in Catalan might find this passage in the Muntaner in Catalan at the Lib of Congress interesting.

kings so He guided these 3 persons; in place of a star He gave them a favorable wind, as favorable as they could ask for, and He did not forsake them until they came safe and in good health to the harbor of Palermo."

The ship steered directly from Barcelona to Palermo. More than 50 horses were embarked, of which those of the Queen and Infantes were in the galleys and were landed by barges at Palermo;⁹ the others in the large nao which did not carry the Queen. The Queen arrived in Sicily in 1283 the King died in 1285 and Muntaner's Chronicle extends to 1328.

OTHER THINGS OF INTEREST IN MUNTANER.

Aragon and Catalonia conquered and annexed the Balearics in 1229 Sicily and Malta in 1282 and much in Muntaner is connected with the naval operations necessary to extend and consolidate these possessions his narrative being capable of connected and scientific treatment; but this cannot be entered on here as it would call for examination of the history of lands bordering the western Mediterranean. Luria being in command of a fleet in 1284, "Had the trumpet sounded and made the people assemble in the stern of the galleys and xx preached to them."¹ The ships were larger than of old; an Athenian admiral 16 centuries before preached to his men in their ships from a little boat.² Apparently the men still lived much onshore when the ships were in harbor; for once on the coast of Italy Luria wants his men and, "The trumpet sounded through the city and the men embarked full of good-will and courage." The mentions of ships lashed together in battle are numerous. In a voyage in the eastern Mediterranean Luria captured 10000 Saracens male and female who were brought to Sicily and sent thence to Mallorca and Catalonia, "He made so much gain that the expenses of the galleys and fitting them out was cleared; all who had come with him became so rich that when they played they would admit no man at the table unless he had gold coins."³ In considerable measure armies and fleets lived on the enemy.

A spy in the service of a Catalan admiral gives the following information of a French fleet at Rosas near Cape Creus 100 miles north of

⁹ P 236 Muntaner.

¹ P 252.

² Above pp 142-3.

³ P 292.

Barcelona in the year 1285, "Every night when they have saluted the sun, they go to the outer point of the port and remain hove-to and so remain until sunrise the next day. Thus they are every day according to this rule for I have been in the galleys more than 10 nights at several times with acquaintances I have there:" saluting the sun is a very ancient and universal practice. This man could not have held life in a galley very dangerous since he goes off to pass the night with friends occasionally. The next extract shows ships *stationary and at a distance in battle while firing projectiles*; an early mention of this. It occurred off Cape Creus in 1285 and concerns the forces just mentioned: a Catalan fleet of 11 galleys and 2 lenys proceed from Barcelona to attack the French fleet of 25 galleys at Rosas;⁴ the French fleet is on the lookout station described above and the 11 Catalan galleys approach at dawn from seaward. When the last are seen the French arise arm and steer for them, "With 15 galleys *lashed together* and 10 following astern in the *intervals between* xx. Assuredly they were ordered wisely. The Catalan galleys were lashed together with long ropes and they *made fast all their oars with long ropes* in order that the enemy should not be able to *get between them* until they wished them to, and until they *loosened the oars and came to a hand-to-hand fight*.⁵ And so it was done. And assuredly I wish you all to know and he who tells you this has been in many battles that *on the enlisted cross-bow men depend the issue of the battle* AFTER THE GALLEYS TIE UP THE OARS. Wherefore always admirals or commanders will do wisely to carry enlisted cross-bow men xx. And whilst the galley-slaves row the cross-bow men are occupied with their cross-bows xx. So they manœuvred the way Catalan galleys should manœuvre xx. They of the French galleys remained sword or burdon in hand unable to do anything xx (does he mean they had no good missile arms). The battle lasted so long that xx the enemy's decks were in great part CLEARED BY THE CROSS-BOW MEN. When the Admiral saw this he had the trumpet sounded the signal agreed upon xx that everyone should SHIP OARS and go among the enemy. And it was done. And when the galleys were mingled you might have seen thrusts with burdons and swords and blows given with maces and the enlisted cross-bow men dropped their cross-bows

⁴ P 329. Luria a few years before in Malta first rammed and then fought until sundown; p 490 above.

⁵ These words, those preceding as to making fast oars, and those below as to shipping them might be made clear by examination of the Catalan of Muntaner by one versed in that language; particularly if he were aided by a seaman.

and rushed to fight hand-to-hand. The battle was hard and fierce and cruel after they had come together but in the end the Catalans xx took all their galleys."

We read of a chart in a ship first in 1270, of compasses there in about the same year, of astrolabes in a ship we have a case in 1283, and in this fighting near Barcelona in 1285 we first read of what came to be called in the days when ships fought under sails the *gun-stage* of an action; the stage when ships lay under easy sail while each strove to gain advantage by gun-fire. It is impossible ships used charts compasses angle-measurers gun-fire in fight before closing for the first time about 1280. The age was indeed prolific but long had missiles been used in 1280 and in many places. Everywhere hand-thrown and slung stones the bow and arrow the thrown spear ante-date the beginnings of history and never was the use of missiles abandoned: we have seen how careful the Northmen were to supply ships with plenty of good stones and Venice had a law in 1279 requiring hers to carry, "Two boat-loads of stones placed where they can be reached." ^a

Muntaner recounts the fortunes of Roger de Flor who began life before the mast and ended, "Cæsar by the Emperor of Constantinople," losing his life at Adrianople. Roger was the son of Richard Blume or Flor whose wife was of Brindisi where ships were plenty, and the boy became a wonderful man aloft; a good topman we would say. Muntaner says; ⁶ this would be about 1291, "When he was 20 he was an accomplished mariner in theory and in practice so that the worthy xx let him do entirely as he liked with the ship. And the master of the Templars seeing him so zealous and expert gave him the mantle xx and bought a great ship from the Genoese the greatest that had been built at that time and it was called the Falcon and gave it to the Frey Roger de Flor." But life at sea palled and Roger recruited the Catalan Grand Company from Aragonese and Catalan soldiers and put them at the disposal of the Emperor at Constantinople; for this he was distinguished by high rank in the exercise of which he met death.

One other circumstance found in Muntaner must be noted for it marks a turning in war; in 1325 near the south end of Italy 2 naos sailing-

^a Jal Arch Nav p 131 v 2: see above p 96 as to accuracy of sling and hand-thrown stones; Locksley in Scott's *Ivanhoe* splits a peeled wand with an arrow at 100 yards.

⁶ P 468: see above p 324 for notice of Blume.

vessels beat off the attack of 16 Pisan and Genoese galleys.⁷ It is unlikely the naos carried gunpowder guns though Capmany gives an original record that in 1359, "A nao defending Barcelona against an attack of the enemy's fleet by a *bombarda*"⁸ had marked effect. Bombardas were large-bore guns often incorrectly associated with high-angle fire, for in pictures they are sometimes shown firing at low angles. Perhaps the naos were Catalan and carried skilful cross-bow men; possibly 500 each, the number onboard the ship in which the Queen went from Barcelona to Palermo; or perhaps the cross-bows were not man-carried but *standing* in a line on the upper deck. They would be wound-up, cocked by winches, and would throw a 10 to 15 pound weight at as great velocity as a gunpowder gun of the day; further they could be fired more rapidly and until they tore themselves to pieces, wherein they had an advantage gunpowder guns do not possess, for nothing can keep them going for unlimited time.

THE EXPEDITIONS OF CHARLES V AGAINST TUNIS AND ALGIERS;
1535 AND 1541.

Charles first of the name in Spain and fifth Emperor of the name of the Holy Roman Empire was the most powerful monarch in Europe, 1500-1558. During his life the western Mediterranean was a Spanish lake while the Turk had the eastern basin; Sicily, the southern part of Italy, coasts of Spain, and the great western islands were Spanish. The Turks held however the coast of Africa; for Barbarossa had conquered these lands for his master and had posts at Tunis Algiers and other places from which ships issued to rob and capture slaves; Christian men and women, taking them from ships and by forays onshore. So greatly were the Turkish pirates feared and so long did the scourge last that towns were set back from the coast leaving a landing-place called the *grau* immediately on the strand.⁹ These robbers though Charles' power was so extended on the side of Europe were at his door; similarly Christian people had possessions in the eastern Mediterranean, Venice occupied Cyprus athwart the gate to Constantinople, and Christian ships traded at Alexandria in Syria and in the Black Sea.

The Emperor probably urged by the Knights of St John now in Malta, only 200 miles from Tunis and from whose shore Turkish corsairs

⁷ P 692: see above pp 471-2.

⁸ Hist Mar Barcelona Madrid p 61.

⁹ Muntaner p 200 note v 1.

were often in sight, determined to destroy the strongholds in Africa: perhaps he would have done better if he had begun by sending war-ships to Malta to isolate the pirates in Africa for their ships necessarily passed near Malta. In June 1535 he arrived at Tunis with a fleet of 500 sail and took the city though Barbarossa himself led its defenders. A very large ship of the Knights of Malta was present and posted in advance of the fleet being said to have had vertical armor.¹ An immense plunder fell into the hands of Charles and many thousand Christians and other captives, "The whole fleet was taken also which caused the Emperor as great satisfaction as the capture of the city; there were 42 galeras, among them those of 26, 27, even 28 thwarts and some with 2 poops as richly carved and over-laid with gold as are seen in the best Christian vessels. Among them was the *capitana* brought by Barbarossa himself from Constantinople a superb ship of great length and breadth and of many *aposenos*;² xx more than 44 *galeotas fustas* and *vergantines*; other round-ships 27, without counting small ones of various types."³ Tunis was re-captured by the Turks 25 years later, to be held permanently; it has been the scene of many interesting episodes for it is on the site of Carthage; its naval history extends over 2500 years.

Encouraged perhaps by success at Tunis Charles attempted 6 years later in 1541 to capture Algiers. His fleet was of about the same strength⁴ and he was accompanied by Andrea Doria now 75 years of age, deemed by his men cold with age when 5 years before he did not attack Barbarossa at Previsa. The force confronting Charles at Algiers was small compared to what had been at Tunis and was not led by a famous warrior; yet the Emperor after loss of many killed and ships cast ashore re-embarked and went home.⁵ There was delay in preparing and Doria advised the King not sail until the spring, but his advice was not taken and the ships reached Algiers and the dis-embarkation began October 20, 1541; a gale springing up next day and lasting several days. Men were drowned in attempting to go ashore ships thrown on the rocks and the men onshore who had only 2 days' provisions and insufficient clothing got out of hand and would not obey orders. The case could not however have

¹ Above p 465.

² Aposento now means a room; a box in the theater.

³ Pp 267-8 v 2 Sandoval, Hist Chas V: here will be found the history of the expedition. Bosio's account is pp 330-32 v 1 his Hist.

⁴ P 92 Exp Chas Quint Villegaignon Grammont.

⁵ Pp 403-11 v 2 Sandoval; pp 354-60 v 1 Bosio; Villegaignon cited note next above.

been desperate when order was given to abandon everything and re-embark for Hernando Cortes Conqueror of Mexico who was in the army advised they should fight. Sandoval who was nearly co-temporary says Cortes, "Understood work of this kind and hunger and how to make a last stand; xx he said if they would let him have the men he had he would undertake to capture Algiers but it is said some of the Council laughed at him." ⁶ Another who came to America Nicolas de Villegaignon was with the Emperor. He was a Knight of Malta and founded a colony of French Huguenots at Rio in 1555 and his story of the expedition is the best we have. In it he raises an interesting technical point: it is commonly said the Christians won at Lepanto, 30 years after Charles' Algiers expedition, because they used hand fire-arms and the Turks cross-bows or bows and arrows; but Villegaignon says of the operations of Charles' men in the rain which occurred after they landed, "The rain had destroyed all use of *escopetas* and *arquebuses* and we had no arrows to repel the enemy, so it was with the *pique* and the bare body we were forced to meet them." ⁷ Fire-arms were fired by a lighted match touched to loose powder lying in a little pan on top of the gun or by a spark struck by a flint into this pan which was exposed to the rain and wind. Would the Christians have lost Lepanto if there had been a shower? Both sides had heavier guns for these were universal by the time of Lepanto and they were fired by the same appliance as portable guns. This is one of the reasons gunpowder guns were slowly adopted.

TURKISH FLEETS IN THE FAR EAST.

In the day of Barbarossa the Turks were opposing the Portuguese in the Far East. As already mentioned there were encounters between Portuguese and Turkish fleets in the Strait of Ormuz, for the Portuguese endeavored to close the Gulf of Persia and Red Sea; they assaulted both Ormuz and Aden. The Turkish Admiral Sidi Ali had sailed with Barbarossa and went to the East about the time Barbarossa died; he was of scientific turn and wrote books about position finding at sea ⁸ which

⁶ P 140 v 2.

⁷ P 66 his work cited. See Toxoplilus, Ascham xx Arber, London 1869 p 82 for comment.

⁸ Travels and Adventure xx Sidi Ali Reis 1553-56 trans from Turkish by Vambéry London 1899: see also Die Topo Capitel des Indischen Seespiegels Mohit von Bittner mit etc von Tomaschek Wien 1897; in this are contemporary Turkish maps: see above p 466.

show he and of course others with Barbarossa and Dragut used the same navigational instruments and methods as Catalans Genoese Venetians Portuguese and others; that is the art of navigation was much the same in the entire seafaring world.

LIFE ONBOARD A GALLEY AS RECOUNTED BY ONE WHO HAD EXPERIENCE.

Antonio de Guevara Bishop of Mondonedo was with the Emperor Charles and left account of his experience; "The passenger in a galley must be humble," he writes,⁹ "Pleasant in speech accepting circumstances for in going onboard he sacrifices his liberty. xx A galley is long and narrow encumbered with oars and ropes. One lodges there as one must not as one would like; you find neither a bench to lie on window to look out from table to eat on or seat to sit on. By special grace you are sometimes permitted to take a little repose on the *coursie*¹ among the cross-bow men or near the *caboose*.² You eat on the deck as the sailors do or on your knees like women. Be careful not to throw water on the deck of the poop still more not to spit there for fear of being rudely called to account by the captain and fined. Sailors spit in our churches but redden with anger when we do as much in their ships. They are the privileged of the galleys."

"When going to sleep do not remove shoes or socks nor your coat; it is the only mattress you will have. Passengers and sailors lie down pele-mele. Your head is where your neighbor has his feet. xx Onboard galleys vermin is in common, lice fleas bugs jump from one to the next. There is a still more intolerable thing; a passenger who has a call of nature or wishes to arrange anything about his person must go to the latrina at the bow xx where they may be seen sitting as at a table to eat. It is useless to ask for clear drinking water xx; the captain if in good humor will permit you perhaps to stop your nose with one hand while holding your goblet with the other. For bread you will have hard black

⁹ P 323 Gravière Cors Barbaresques: the original is pp 22-43 Guevara, *Libro de los Inventores del Arte del Marear y de los Muchas Trabajos que se Passen en las Galeras* Pamplona 1579; there is a copy in the Boston Pub Lib but nothing in it of what we call navigation; *arte del marear* Guevara called it in common with most of his day. See below pp 514 and foll'g for another description of life in a galley: also picture at p 514.

¹ See pictures pp 78, 81.

² The place where food was cooked. By this time cooking was done onboard, being necessary as oarsmen were slaves chained to the thwarts. The slaves had often uncooked food at sea for Pantero Pantera says about 1620 it is not easy to cook in galleys: a little further on however he speaks of how fire-wood may be brought onboard; Jal Arch Nav v 1 p 304.

biscuit full of worms covered with cobwebs already gnawed by rats. The meats served, he-goat mutton beef buffalo or rancid lard, is badly cooked and seasoned, as hard as wood salter than salt as hard to digest as a stone. As to wine it is of the kind used to dress salad onshore. Have you finished? Then wipe your mouth on your sleeve. You will receive no napkin."

"We have not yet the ordinary miseries of navigation. At sea when a storm arises all lights are instantly put out; there is no longer a question of dining xx. You are told to go below-decks for the decks must be unincumbered at such times.³ The crys of the sailors the noise of rapid steps overhead the tumult accompanying work on deck will cause you more fear than the combing seas xx. God preserve you from a baffling wind. Every time the wind changes when it passes from one side to the other the lateen-yards are lowered each time to be re-hoisted. Do not lose sight of it, protect also thy face if possible. The tempest comes and bursts; thy head swims thy vision is confused thy stomach revolts; a deadly sickness is upon thee, rush to the rail the nausea has overcome thee. I see thee sink presently almost inanimate. Do not hope for a charitable hand to hold thy head, all near split themselves with laughter xx."

PROCURING CREWS.

There is a report written by Cristofollo da Canale Proveditor of the Venetian fleet in 1556 as follows,⁴ "Galleys manned by condemned men surpass those rowed by freemen but magistrates should send only healthy men to the galleys. The great advantage of the former is that when any unexpected service is required they are ready but it is impossible when near shore to refuse to allow free rowers to go there. In case of sudden need it is quite an affair to fetch all onboard. There is no fear of thefts or mutinies with condemned men for these are chained and cannot leave the thwarts. The first to applaud manning ships by slaves will be the magistrates of cities for they will thus be relieved from the continual claims of inhabitants regarding theft quarrels tumults and fighting caused

³ Bosio Hist Malthe v 2 pp 271-2 gives rules in galleys of Knights of Malta requiring knights to go below in bad weather.

⁴ Pp 25-36 v 1 Gravière's Guerre de Chypre. The history of the manuscript from which the Admiral takes this is given; it is un-translated and un-published. Jal Glos Naut gives *proveditor* as the officer in Italian fleets next to the commander-in-chief; charged with procuring supplies. What follows concerns it will be noted both freemen and those forced to serve.

by the presence of free oarsmen onshore. The last war we had with the Grand Seigneur stripped Dalmatia. All inhabitants dwelling near the Turkish frontier fled xx and many of these have died in the years of want following. I estimate the population of Dalmatia on which we may depend for galley-men at 103000. From these must be deducted xx; there remain 18000 men of whom a fourth to judge by information I am in receipt of may be fit to serve in galleys. In these 4500 will you find 1500 willing to serve voluntarily at the oar? I doubt it. To see those who return to their homes from this service, naked barefoot and with not a sou saved, hardly encourages others. xx The money allowed no longer suffices to obtain x x volunteer oarsmen. There is hardly a captain who does not disburse in increased pay and bounties as much as 3000 ducats. xx Poorer captains run a risk of losing their men, command of a galley is no longer possible for a poor gentleman and many young noblemen seeing they can never hope to command a galley have left the service."

"Within 10 years if we are not careful our old crews will be gone and we shall be unable to recruit new ones. There is no work so hard so fatiguing that a freeman would not prefer it to service at the oar as it has been in the last few years. The remedy is easy. I have interrogated the old hands and it is from them I have my propositions. Firstly there should be paid men designed for embarkation $\frac{6}{10}$ the money which will be paid during the voyage. Of this sum the oarsman will leave $\frac{2}{10}$ to his family confiding to them the care to make some profit with this during his absence and with the remainder should be bought a wool blanket a coat a barrel a half-tub a certain quantity of vermicelli, all things necessary to a galley-man. Also while the man is in service the subsistence of his family should be assured by the administration, a sufficient credit being always open at the baker's and other shops. Salt the most indispensable thing the most prized by all should be delivered gratuitously to the father mother wife and children of all men present in galleys of the Republic. If you adopt these measures the service will again become popular and you may maintain 22 galleys in Dalmatia armed with freemen and a reserve of oarsmen for 20 or 25 more galleys. A small half-pay will ensure their service at the first call xx."

"At this time," he continues, "You have about 1200 men at the chain; 155 oarsmen are enough for a galley in time of peace. I would advise you to send the galleys rowed by condemned men to Cyprus to

remain till September and pass then to Crete where they should remain till March. Cyprus needs no guard of galleys during winter. In September no long-ships will be found there. At Crete on the contrary the galleys will be very useful. The vessels of Christians as well as of the Infidels profit by the winter season to ravage the islands in the Archipelago. They do not fear the sea for there are excellent and numerous shelters; the inhabitants of Crete live in perpetual fear and only a continuous watch can procure for them a reasonable security.⁵ The term of service of a *comitre* of slaves is 36 months and he should pass 2 summers at Cyprus and 1 winter at Crete xx. At the end of 18 months he should join the fleet in the Adriatic. Then he should become acquainted with all the ports and creeks in Dalmatia. Thus he would become not only a good seaman but capable pilot. With the cost of a free galley there is no difficulty in providing and maintaining 2 galleys manned by slaves for only the *comitre* the seamen and the soldiers receive pay.”⁶

“I can affirm Venetian galleys are the best in the world with oars xx but not good under sail. Their freeboard is not sufficient xx and they are loaded too heavily. Each slave wishes to carry a sack of wine and 2 of water under his thwart a cloth cloak and a blanket—do not forget there are 3 men on each thwart. All these weights of which the constructor has not taken account⁷ make the galley float deeper xx. Under sail by the wind the rail is under water throughout the whole row-chamber. By this the vessel loses half her speed.”⁸

This is a very important passage: the feet of the oarsmen were 18 to 20 inches above water when the galley—a very *tender* craft—was on even keel; (1) each oarsman carried wine and water in barrels under his

⁵ This means pirates in long-ships because the islands of the Greek archipelago many of which belonged to citizens of Venice were near found it worth while to keep the sea all winter near Crete; but near Cyprus more in the open sea there were no burden-ships and no pirates. The pirates were Infidel and Christian.

⁶ The *comitre* guided controlled and piloted the ship, was the seaman who cared for her, *soldiers* were landmen to fight, the *seamen* handled the sails and anchors, were seafarers which oarsmen were not.

⁷ That is ship-constructors calculated displacement buoyancy etc as they do now: ships now are found to float otherwise than as designed for the reasons stated by Canale.

⁸ The freeboard in row-galleys was very small; p 92 v 1 Serre in a cross-section of a galley, the outer edge of her deck—all that keeps water coming over the rail from swamping her—is 18 inches above water when the craft is on even keel. A light breeze put the edge of the deck under water: when rowing against a sea galleys shipped water enough to cover the men's feet which charging about detracted from speed and endangered foundering.

thwart—had they done the same always, for in ancient authors there is no statement to this effect; (2) the rowing was *scaloccio* 3 men on each thwart on each side pulling one long oar; (3) since there were 3 men on a thwart 6 counting both sides the beam of the hull was about 18 feet; across the *telaro* or *aposti*, outrigger carrying tholes of oars quite 24; (4) since there were about 220 oarsmen there were nearly 40 thwarts and the vessel's length was about 150 feet. From the coursie to the keel was about 9 feet; from the feet of the oarsmen to the keel was 7 feet making the height below-deck a little less; the draft was 4½ feet.

Resuming the narrative of Canale: "Not long since I met Djafer Pacha captain-of-galleys to the Grand Turk at Navarino and offered to go with him to Lepanto. I got underway with him he having 5 galleys and I 6 and a good breeze lasted for 120 miles: Djafer xx twice shortened sail to wait for me. My chagrin was great. xx The Turks now knew that in case of necessity they have only to make sail to escape. It is easily explained. xx Their galleys carry the deck a half-foot higher than ours, their sails are half the weight of ours. They use in these a very light cotton very close woven while our sails of hemp are so heavy that when wet they incline the rail of the vessel to the water. I asked Djafer if during this run in the winter season—we were in the month of January—he had lost many oars: 'One,' he replied, 'an old one broken in the middle.' I can affirm to Your Highness that if the galleys of Djafer should pass in the month of January from Barbary to the Sapienza Islands without losing all their oars and staving their upper works the height of their vessels would be the cause."

From Tunis the nearest port in Barbary belonging to the Grand Turk to Cape Passaro the south extremity of Sicily is east 250 miles, and from Cape Passaro to the Sapienza Islands east 450 miles; no land except Cape Passaro would be seen. Evidently such passages 700 miles, a week or more with a good breeze, were made and in winter season. What did they do with the oars,—as long and heavy as a small mast. No-one tells and the only solution I have seen is in Jal's *Glossaire Nautique* p 749 where the handles of the oars are lowered until the blades are well above water and fastened in that position. This would not do in a rough sea as oar-blades might be caught by the water. It is not clear how Canale and Djafer could use both oars and sails in their run of 120 miles which Canale says they did do. When about to use sails or when bad weather

threatened oars must have been laid inboard entirely and lashed. The waves went clear over a galley as over a half-tide reef; everything loose was washed overboard often doing serious injury to ship or men before going. Yet to lash 50 to 75 oars 45 to 50 feet long on the upper part of a vessel 150 feet long and 30 feet wide, already filled with men, seems impossible. But it must have been done, for in a brisk gale and sea oars with blades cocked up might catch the sea and cause disaster: see picture at p 463.

"Too small a freeboard is not the only fault of our galleys I would report to you," Canale goes on, "We put too many guns in them; with the wind astern the vessels plunge as though they would go to the bottom xx. No galleys have so many guns in the bow as those of the Republic, and the masts are too far forward and too high when the small freeboard is considered. In my run with Djafer we tried our speed with oars and the advantage is all with us for in a little while we distanced his vessels. xx I summarize my observations; if Your Highness will increase the freeboard of your galleys lighten the sails cut the masts shorter and move them astern and lighten the weight in guns I will answer for their success on all occasions."

THE BATTLE OF LEPANTO.

Lepanto was fought October 7, 1571. The Turks came steering west while the Christians were steering east, their speed being increased by a faint breeze from west. The fleets were probably in a single line abreast though there is warrant for statement the Turkish fleet was in a crescent with concavity toward the enemy. About $\frac{3}{4}$ -mile ahead of the Christian line were spaced across its front 6 great galleasses of 50 oars carrying heavy guns on the broadside. These vessels of low oar-power had been aided in reaching position each by 2 galleys towing. "The fate of the world," writes Admiral de la Gravière,⁹ "Has depended 3 times on the issue of a struggle on the sea, it may depend on one again. I wish after recounting the battles of Salamis and Actium to study as a seaman and not a historian only the encounter of Oct. 7, 1571 which over-threw Ottoman supremacy. The Battle of Lepanto was fought by fleets of nearly equal strength in waters already reddened by the combat of Octa-

⁹ *Guerre de Chypre et Bat de Lepante* v 1 p XXXVIII: see also *Hist Com Lepanto* Rosell Madrid 1853; and Stirling-Maxwell's *Don John of Austria* cited below.

vius and Antony and more recently by Doria and Barbarossa.¹ There were 172000 men present 84420 in the Christian and 88000 in the Turkish fleet. The loss of the successful fleet which alone can be correctly given was more than 15000 xx, while that of the conquered must have reached 50000; 12000 Christian slaves were released from the chain."

The Turkish vessels fired their bow guns at long range as they approached, the Venetian galleasses opened at noon, at four in the afternoon the Turkish ships were flying northward. As they approached to ram and to fight bow to bow the Turkish crews made a great uproar keeping at top speed and opening the line where necessary to pass the Christian galleasses which were firing on them. When near enough small-arm fire began there being many man-carried gunpowder guns in the Christian but none in the Turkish fleet. During the approach by order of Don John of Austria, half-brother of Philip of Spain and commander-in-chief of the Christians, crews and officers knelt on the deck and the priests bearing crucifixes passed among the kneeling men; "There is no paradise for poltroons" they were saying.²

The strength of the Christian fleet is disputed. Before he sailed from Messina where his fleet assembled Don John wrote, "The enemy is stronger than we are in the number of his vessels but not so I believe in quality either of vessels or men. So I sail please God tonight for Corfu and thence according to what I shall hear. I have with me 208 galleys 26000 troops 6 galleasses and 24 naves."³ The Turkish fleet comprised it is said 300 galleys commanded by Ali-Pacha; he met death while his ship was fast to that of Don John; Ouloch-Ali a renegade Christian and corsair as famous as the Barbarossas or Dragut commanding the left or

¹ Actium 31 B C and Lepanto were at the mouth of the Gulf of Arta, 50 miles north of the mouth of the Gulf of Corinth. Previsa between Turkish and Christian fleets under Barbarossa and Andrea Doria in 1535 was in the same place. Lepanto is by some called Curzolari; the name of an island 10 miles north from where the battle occurred where the Christian fleet anchored for the night after the battle.

² Don John Austria Stirling-Maxwell 2 vs p 346 v 1.

³ V cited note next preceding p 327. A note on this p speaks of, "The flag-ship of Don Juan with her lofty poop rich with the delicate carvings in which the Sevillian brush and chisel of Vazquez had embodied the emblematical skill of the learned Mallara;" but says nothing of her size or class. The same v, p 367 says the galley of the Turkish comdr-in-chief, "Was a large and splendid vessel with a deck of black walnut and much internal and external wood-work carved and gilt, its cabin was profusely decorated with sculpture and gilding and the richness of its hangings embroidered with silk and gold was excelled by few palaces." Don John's 24 naves carried food water and large part of the 26000 troops with him. There was it will be observed 1 nave to 8 galleys, the former being round-ships perhaps 150 feet long and 50 feet beam.

south wing. Ouloch-Ali was 60 and had followed the sea 40 years. He was esteemed a skilful tactician and edged off south as he approached, threatening the Christian right with attack in rear. The Christian center was gaining advantage and Jean-Andrea Doria, nephew of the famous Andrea, in command of the right wing, edged south to prevent Ouloch-Ali flanking him. This Doria like Andrea of the preceding generation was esteemed a tactician; books go into explanation why Andrea Doria commanding a superior force at Previsa allowed Barbarossa to go without fighting and why this Doria nephew of his uncle was led by Ouloch to open a gap in the Christian line. The Turk led him away for a time then turned to thrust into the interval between him and the main Christian fleet, whereupon Doria returned also but only in time to save the center from flank attack.

In the Christian center commanded by Don John was Sebastian Veniero commander of the ships of Venice, now 70 years of age. He was not cold with age as the men said Andrea Doria was at Previsa and his conduct won for him election as Doge. Under date December 29, 1572, he wrote to the Doge and Senate in Venice a report of the battle: he says,⁴ "As the day broke the whole Turkish fleet came into view. Don John came astern of me and said, 'Are we to give battle?' I replied, 'We must, we cannot do otherwise.' His Highness then went through the fleet. We placed the heavy ships 2 and 2 together a little in front, the galleys could not be got into a correct line and this gave me a little annoyance. On my left side toward the rocks was Barbarigo, on the right toward the sea was Giovanni Doria. xx The enemy's fleet divided itself and avoiding the heavy vessels bore down on us and we on them. In front of us chiefs were 4 enemy's galleys bearing the lamp of principal officers. Don John attacked the ship of Pasha Ali prow to prow and I at midships.⁵ Four galleys then attacked me on the left side but by God's will all went by my stern and turned back toward my right side on which they were met by those 2 most gallant gentlemen Messer Chatarin Malipiero and Messer Zan Loredan⁶ whom I had sent to call; they attacked 2 of these galleys and

⁴ Stirling-Maxwell p 327 v 2.

⁵ Veniero had previously resisted an attempt of Doria, a Genoese, to inspect his ships, had hung Spanish soldiers for rioting in his ships, and threatened ships in the fleet with his guns. The ships assembled by the urgency of the occasion and energy and efforts of Pope Pius V had been arrayed against each other in many fights.

⁶ These were in a reserve of 35 galleys formed behind the line; p 58 v 2 Gravière's Lepanto.

most valiantly fighting were slain. My galley with its artillery arquebuses and bows prevented the passage of a single Turk from the poop of the Pasha's vessel to the prow by which means Don John had a fair field in which to board and vanquish the Pasha who was slain in the battle. Besides fighting at the prow I fought with one galley on my right quarter and with another somewhat further astern. At length my people boarded and planted my banner xx. Of the Turks part were brought onboard my galley and part chained and shut up in their own xx. Seeing Don John fighting at a little distance I was going to help him but he beat off his assailants and so ended the battle which had lasted 3 hours and more. xx The 2 galleys which I had taken were towed away by their sterns by 2 Spanish galleys. xx I saw I cannot tell how many Turkish galleys with their sails set escaping in the direction of Santa Maura,⁷ and desired to attack them but could not, some of our galleys being entangled by their prows. When I arrived at the Curzolari Islands His Highness sent his boat for me and when I went onboard he made a world of caresses embracing me and so did all those captains and gentlemen, greatly extolling to one another the gallant battle xx. The truth is seen in the killed and wounded; my flag-captain and xx others to the number of 106 being wounded and the chief of the soldiers a *bombardier* and other 4 killed. I was slightly wounded in one of my knees. xx Some of our galleys were roughly handled and their captains slain each of them having had 4 or 5 Turkish galleys to deal with xx."

Other facts are in the record of Lepanto. Don Juan was in his 24th year. Three years earlier he had been appointed General of the Sea and Commander-in-Chief of the Fleets of Spain, replacing Don Garcia de Toledo who had been long in service, and being given as Vice-Admiral Don Luis de Requesens y Zuniga an experienced seaman.⁸ Toledo delivered an opinion of much interest when Don John wrote to ask whether it was advisable to with-hold fire as galleys approached; "In my judgment," Toledo replied,⁹ "The troopers are right who say you should never fire

⁷ To the north.

⁸ Philip's letter dated 23d May 1568 appointing him is at p 69 v 1 St-Maxwell. It is addressed, "Brother" signed "*Yo el Rey*" and full of pious and kindly advice, such as, "Be very careful xx that your tongue be an instrument of honor and favor and not of dishonor to any-one;" The Spanish have a saying, "The politeness of the lips costs little and goes far;" perhaps Philip whose character as portrayed is sinister and forbidding had somewhat to redeem him.

⁹ Stirling-Maxwell p 323 v 1: the place of the original letter is stated. See above p 175.

your arquebus until near enough to be splashed with the blood of your enemy and I have always heard the most knowing captains say that the crashing of a ship's iron beak and the first report of her guns should be heard at the same moment and I think so too. But your people should be taught not to be considering the enemy or who is to fire first or last but to fire when Your Highness gives the word and then only."

In these days men served indifferently on land or sea. Cervantes was in the ship of Doria, the Marquesa, and was wounded; "Lost the movement of the left hand for the honor of his right," he said; and books have been written by his countrymen to show both that he was a soldier and a seaman; so we may conclude he was both.¹ Prohibition of women onboard as usual in these days is found in Don John's orders² but was here as also usual without effect, for in his own ship was a woman called Maria la Bailadora, Maria the Dancer. She is known because after handling an arquebus with effect she went with the boarders into the Turkish flag-ship and slew a Turk in hand-to-hand fight, in consequence of which Don John ordered her name carried on the ship's-books. Since she was in his vessel he must have known it and no doubt there were women in the other ships of the fleet.³

The lines-of-battle were single and either straight or concave toward the enemy; there were about 210 ships in each fleet; to give room for the oars the lines must have been 7 or 8 miles long. When the ships first saw each other being east and west at daylight they were about 8 miles apart. Each rowed toward the other, the sails being furled on the lateen-yards and these half-way up the mast and steadied by ropes to the ends of the yard from sides of the ship—*vangs* we call these. As the Turks approached they opened fire with bow guns, also the 6 heavy ships in front of the Christian line opened, but we do not know the range or effect. The ships of the commanders-in-chief were in the center of their lines, each flanked on both sides by ships of the heaviest rates, and as bound by good manners each held her stem on the other; when the flag-ships met we are told, though the authority is not given, "The lofty prow of the Turk towered high above the forecastle of Don John and his galley's beak was thrust through the rigging of the other vessel until its point was over the 4th rowing-bench. Thus fast together the 2 flag-ships became a battle-

¹ Stirling-Maxwell p 359 v 1 and above p 312 n 2.

² Jal Arch Nav p 109 v 2.

³ St-Maxwell p 359 v 1.



The Battle of Lepanto 1571: the picture is from pl 175 Zanotto's Palazzo Ducale; it is marked in Zanotto, "Victory of the Christian fleet in year 1571; painted by Andrea Vicentino:" in Zanotto the picture is larger than here. The rowing is scaled down. No doubt this represents the ships as they looked and the manner of the fighting. The ship in the right-center has its flag hoisted half-way; crow's-nest but unoccupied at the mast-head; the Christian flag is flying from the mainmast.



[a near-by island where the Christian fleet anchored the night after the battle] won by the Christians again. The engraving gives names of ships and captains: in the picture the Christians are to the right and Turks to the left. The Venetian commander of those of Venice; her upper deck is given up to fighting men; she has sails furled and the Turkish arms and Veniero's ship has just fired a large-bore gun on port quarter.

field which was strongly contested for about 2 hours.”⁴ During this time Ouloch-Ali led Doria away to sea leaving the right flank of the Christian center unguarded and when distance was gained turned northward and fell on the flank of the Christian center, Doria returning in time to save the day but none too soon.

Upon study of existing paintings of Lepanto our conception will be accurate. The battle made a great noise in the world and Titian the renowned painter though 90 years of age was appointed by the Doge and Senate of Venice to paint it, but never executed the commission, and Jacopo Robusti called Tintoretto a co-temporary of Titian offered to do it within a year without recompense and accomplished this. It is not known where this painting is, but Andrea Vicentino who was 30 years old when the battle was fought executed a painting which is in the Ducal Palace at Venice.⁵ This is very large; a re-production on fair scale will be found v 3 Zanotto's Palazzo Ducale di Venezia p 175. It is the most interesting picture in the world of a battle on the sea, for the artist must have conversed with many who were in the battle, and Veniero who commanded the Venetian ships was Doge when it was painted. It represents fighting in all ages. Thucydides would acclaim it as showing the Syracusan and Athenian fleets in Syracuse Harbor in 415 B C but not the tactics he represents Phormio to have followed; Polybius who describes tactics of the nature of those of Phormio would think it brutal and untrue; while Livy, who makes both ships and armies on shore fight by advancing until the enemy can be reached by the sword, would say it shows the fighting at Myonnesus and other places. In modern day in the day of sails it is also like; Admiral de la Gravière says the struggle in the center was like that around Villeneuve at Trafalgar; it equally resembles the scene at the Nile, that when Hawke followed the French into Quiberon Bay on a wild night, and Rodney's ships around the flag-ship of de Grasse in the West Indies in 1782. Only when sails go out and steam comes in and ships are at speed in fight does the likeness fail; though then ships may gather about an enemy whose engines have failed.

⁴ St-Max Don John v 1 p 351: Gravière Bat Lepanto v 2 p 180 compares the fighting around the ships of Don John and Ali Pasha with that of those of Nelson and Villeneuve, Victory and Bucentaure, with the English Temeraire and French Redoutable fast to them, at Trafalgar.

⁵ As regards paintings and poems, see Stirling-Maxwell pp 377-8 v 1: here is stated the stage of the battle represented in Vicentino's painting; copy is here inserted.

There is an almost co-temporary author who wrote of Lepanto not yet alluded to; de Thou born 1607 died 1642.⁶ When Don John's fleet was about to sail from Italy de Thou says, "At this time Caragiali an old corsair did a bold thing: he came into our fleet in the night counted at his ease the number of ships and landing captured 4 soldiers who were strolling on the beach. They were interrogated separately⁷ and said the Christian fleet consisted of 206 galleys and 6 great galeasses and that they were coming to fight." Then follows about indecisions in the Turkish fleet whether to fight and the like among Christians. Our author continues, "The Turkish fleet was seen by ours Sunday October 7 at sunrise xx being distant 4 or 5 leagues and Don John formed line-of-battle. Barbarigo who commanded the left brought his ship as near the land as the depth of water would permit xx and the other captains arranged their ships without disorder or embarrassment. xx The 6 great galeasses were arranged in front in a line. John of Austria was in the center, having on his right the flag-ship of the fleet of the Pope on his left that of Venice and beyond these the flag-ships of Savoy and Genoa."

"As the Christian fleet approached the Turks lowered their sails then raised⁸ their lateen-yards and prepared everything. As this nation is very disciplined they formed line in a moment, xx their line was not a crescent as it usually is but a straight line. John of Austria hoisted the flag showing the arms of the confederated princes implored the aid of Heaven descended into a small boat and gave the order to Requesens and Colonna to do the same and went from vessel to vessel exhorting all to fight with courage under the banner of Christ. xx The signal was given in each fleet by firing a cannon. At once the Turks' left opposite Doria xx commenced to out-flank our right." Then follows a description of how Doria followed the Turks and how this was explained, and the author goes on, "When the Turks were within range of the Venetian galeasses they received several discharges from these vessels. The Turks breaking their line passed without order the galeasses xx then with fearful cries as is their habit they began the combat at one hour after noon by a cloud of

⁶ Hist Universelle 1543-1607, 1734 16 vs: the parts quoted below are v 6 beginning p 233.

⁷ This means under torture.

⁸ Presumably they came out of the Gulf with sails for in the morning the wind was east, later it changed to west, fair for the Christians: sails furled on the lateen-yards and these hoisted half-way. They could not be left down and were better hoisted half-way than all way.

arrows. At this time Barbarigo⁹ was in the thickest of the fight xx and was struck in the eye by an arrow, dying of the wound next day. The Turks being overcome here ran their ships ashore where they were masters leaving the ships on the rocks without defenders. Soon the sea xx was red with blood xx and the air obscured by powder smoke; xx the noise of the fierce shouting and of the arquebuses and cannons was deafening. The galleys were coming together bow to bow, poop to poop, for some approached the enemy and attacked astern; in a word caprice and accident led to these movements more than prudence and reason."

"Never was there so frightful a spectacle or one more worthy of pity. Turks came swimming to our ships and catching the oars or rudder begged for mercy but the soldiers had lost all sense of humanity in the ardor of combat and cut off their hands though some less cruel or more avaricious threw them ropes and hauled them onboard to be sold as slaves, by which they could make money. xx Ouloch-Ali having got rid of Doria plunged into the battle xx. Doria was so far away as to imperil the Christian fleet xx but finally arrived and put himself to pursue Ouloch. The thick cloud of smoke and rising sea and wind made this unavailing however. Some 30 Turkish galleys which were onshore were captured. The Turks having fought with great obstinacy though in disorder from one hour past noon until sunset no longer made any resistance yielding to the Christians a complete victory. Such was the success of the Battle of Curzolari. It was the greatest victory yet obtained over the Turks and the one from which the least advantage was obtained: the disputes of the commanders and the contrary interests of the confederates caused this loss; instead of having in view the glory of God and the good of Christianity each sought his own advantage."¹

"Many things," our author goes on, "Contributed to this victory. The Ottoman fleet was more numerous than ours and was composed of 264 vessels while the Christians had only 205 and the 6 great galleasses but we were superior in number of combatants. Besides 25000 men of regular troops in no galley was there less than 200 soldiers or at least 150. The crews of the naves and slaves even who were promised their liberty fought with courage. In the Turkish ships except those of the

⁹ Commanded the Christian left or north wing: his left was very near the land, held by Turks.

¹ But see, St-Maxwell v 1 p 403 for Don John's efforts to follow up the advantage: in the following spring a Turkish fleet ravaged Venetian islands in the Greek Archipelago in usual manner; see also Daru Hist Venice v 5 p 147.

principal officers who carried the crescent in their flags which were about 30 in number there were only 30 or 40 soldiers and 100 in the principal ones. These were all exposed as they wore no defensive armor. Our soldiers xx all wore helmets and cuirasses. xx The Turks had few fire-arms and their arrows had much less effect than bullets from arquebuses; they had indeed no effect on defensive armor; moreover when a bow has fired 4 or 5 arrows the cord becomes stretched and the arrow hardly penetrates the skin. Moreover our galleys had parapets and the Turks had none, for parapets are not convenient to fire bows over, thus our men had a rest for their arquebuses which made their fire accurate. xx Also the prows of the Turkish ships were without cover and thus their cannoniers were killed by our arquebuses or obliged after one discharge to abandon their guns. Our galleys on the other hand all fired 4 or 5 times and some of them more and when ships were fast to each other we could still use our cannon and never miss.² The spurs of our ships had been cut off for their ends curved upward made it necessary to point obliquely;³ and after this our guns were pointed at the enemy's water-line and no shot was in vain, while the cannon of the Turks being pointed high their shots passed over our heads."

"There were taken 130 Turkish galleys of which only 14 were small; all the rest of the vessels were burned or sunk or broken on the rocks so that of this great fleet only 50 galleys escaped. Ouloch-Ali went to Constantinople with the 30 he saved. The Emperor was at Adrianople xx but returned to Constantinople in haste. He not only received Ouloch-Ali but gave him command of the entire navy of the Empire. In this he

² The slow fire of early gunpowder guns both man-carried and standing was a cause of their slow adoption. It was due principally to poor mountings. The old block of wood with 2 or 4 little friction-making wheels under it and a rope breeching to catch the gun when far enough recoiled was well-handled sometimes though: it is said Collingwood would tell his men a crew that could deliver 3 well-aimed broadsides in 2 minutes was invincible.

³ It seems ridiculous the spurs should interfere with the guns but the story is told that monitors during our Civil War occasionally fired through their smoke-pipe rather than change a course prescribed. It is not unlikely the story may be true for it is often repeated, though what Toledo an experienced sea-captain said (p 507 above) tends to disprove it. The guns were about 4 feet above water and the point of the spur, which was very long, about 2 feet lower than the guns and 2 feet above the water: when the *coursier* the central and heaviest gun at the bow was depressed as much as was possible without striking the spur the ball would strike the water about 35 feet ahead of the vessel; the other guns could be depressed as much as desired: see what is said p 508 above as to the spur of the Turkish flag-ship and pictures of galleys at pp 77, 81.

departed from usual Turkish methods, by which unsuccessful commanders are punished though the fault may not be theirs. If one is beaten by pure accident he is strangled as though he was the cause of the defeat. The Turks lost 25000 men killed and 3500 prisoners xx. We lost 15 galleys of which 10 were Venetian, attacked by Ouloch-Ali in his first onset xx: the freeing of several thousand Christians from the chain was enough to assuage all our losses. The enemy made a great blunder in this battle: being able to fight in the open sea and give battle there they preferred to fight near a coast in their possession xx; what happened was this, those near the land being disordered by our charge in which the Turks put every effort made for the beach abandoning their vessels and dispersing themselves in the neighborhood."

The pages of history contain many cases of opportunities neglected. Our author goes on as to why the fruits of victory were not secured: there were differences among the commanders; Venice whose stake was by much the greatest had sent 13 galeasses as a reinforcement which arrived only after the battle. The commander of these Philip Bragadin begged he might be given the 6 galeasses already in the fleet and 50 galleys, "To pursue the remains of the Ottoman fleet to spread terror in the land and to regulate his enterprises by the events which might occur." But no pursuit is recorded though on the night after the battle the Christians were between Ouloch-Ali's remnant of his fleet and Constantinople.

The Christians used hand-grenades—containers filled with gunpowder and fitted with fuze, after lighting which by communicating fire to it the grenade is thrown by the hand among the enemy; "A captain of Spanish artillery had his left hand mutilated by a grenade he was about to fling among the Turks," we are told.⁴

THE INVINCIBLE ARMADA.

The Invincible Armada was sent by Philip of Spain for the subjugation of England and was in the English Channel July and August 1588. Both Spanish and English fleets consisted of round-ships sailing-vessels though some long-ships were in the original muster in Spain. Lepanto 1571 was the last world-famous battle in which oar-vessels formed the bulk of the fleets though these were used until 150 years later. They were little fitted for service in the Ocean where harbors are not near and there are many places a lee cannot be quickly reached. The circumstances

⁴ Stir-Max Don John v 1 p 358.

connected with the mustering and fighting of the Invincible Armada have been often described and it is enough to say that the large high-sided Spanish ships after being cannonaded by the more active English and driven from their anchors at Calais fled away around the north of Scotland back to Spain. The ships were all sailers, too large heavy and high to be driven by oars, but not larger than some row-vessels of which we read in Mediterranean service. By the day of the Armada sailing-ships were capable, tacking and working with certainty.

The Duke of Medina Sidonia commanded the Spanish fleet and wrote on receiving his orders requesting the King be informed, "He knew nothing of the sea or of war and so was incapable of commanding the Armada and the Day of England." But he accepted the office⁵ and the King thanked him and created him Capitan-General de Mar Oceano. Though the commander-in-chief knew nothing of the sea there were experienced seamen in the Spanish ships: much might be said as to whether they were heard in deliberations, but the King's orders were positive that the fleet should join the Prince of Parma and cover his army crossing the Channel to England and this was obeyed by the Duke. Some say he should have seized a harbor but he kept on to join Parma followed and harassed by the English until he anchored at Calais. Fire-ships caused him to cut his cables here and he fled to the north; the Armada had failed though much destruction was still to be done it in the high latitude it reached.

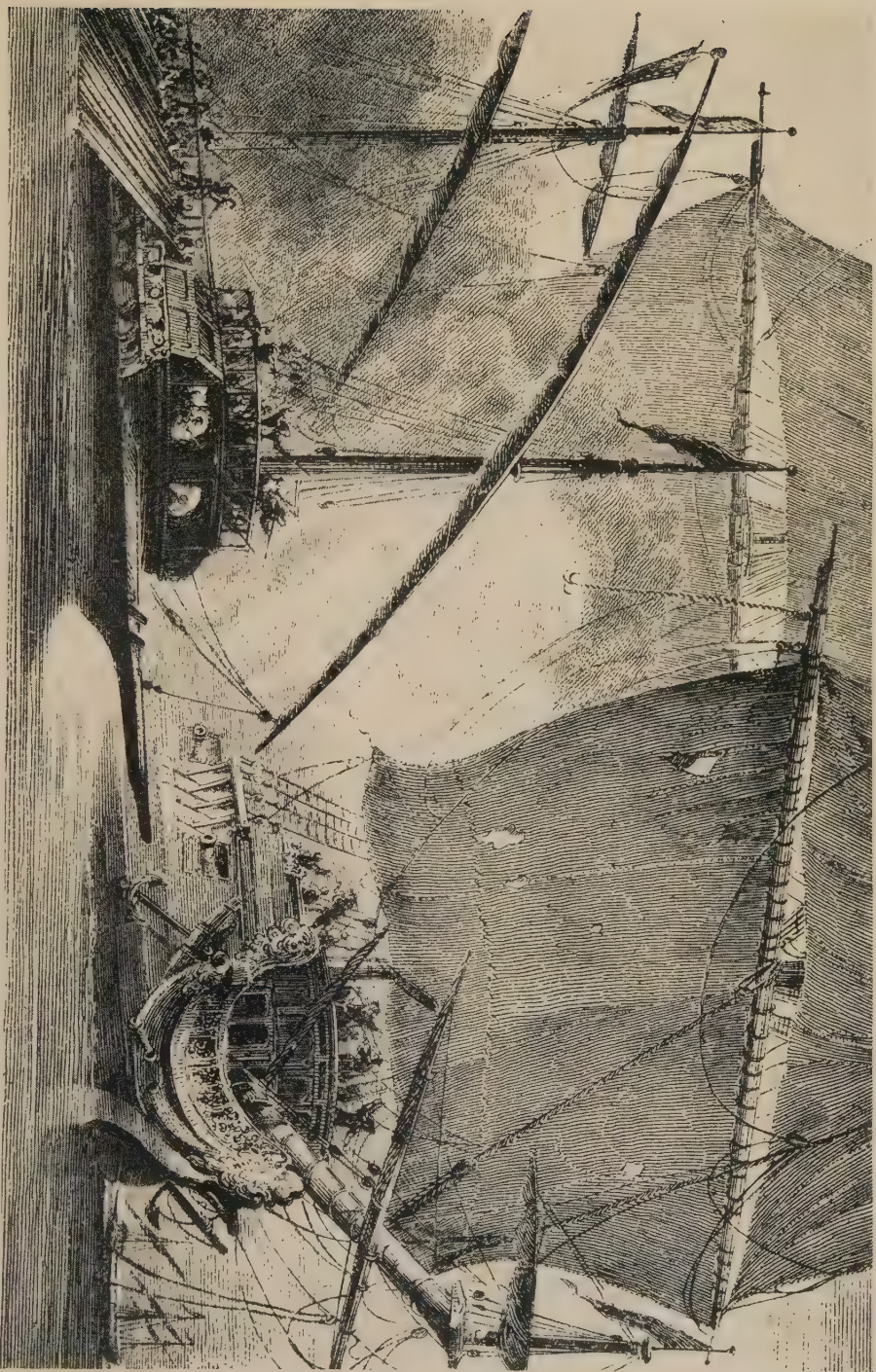
The story is told by de Thou⁶ who may have known persons in the fleet. He begins by saying the English fleet, "Was commanded by Charles Howard grandson of Thomas Howard Duke of Norfolk rendered famous by his victory over the Scotch and descended from the Plantagenets who for 400 years reigned gloriously in England. He was given for vice-admiral a man of a birth very different but whose skill at sea was well known; the famous Francis Drake."

A GALLEY SLAVE'S DESCRIPTION OF LIFE IN A GALLEY.

In a book called *Memoires d'Un Protestant Condamné aux Galeres de France pour Cause de Religion Ecrit par Lui-Meme* is the best description of oar-ships and life onboard. It is applicable so far as the vessel

⁵ Armada Invencible Duro v 1 pp 414, 429, 434. On p 435 is the King's letter diminishing the ration of wine in the ships and p 426 the one requiring the crews to confess and communicate before embarking and ordering, "No public or private woman shall embark in the said Armada."

⁶ Hist Univer cited p 510 n 6, v 10 pp 177-91.



* This is frontpiece Mem d' un Protestant etc identified p 514 ; the date is 1700. P 177 it is stated to be between a galley and an English frigate; the former tried to run astern but the frigate avoided, "We passed so close," the Protestant continues, "all our oars were broken in pieces, x x The ship's guns were loaded with grape the tops full of men with grenades which fell like hail x x. Those not killed threw themselves flat on deck."



This is a picture in the *Mem d' un Protestant* identified p 514 above. The offender is laid across the *coursie* and a Turk flogs him the *comitre* standing by to see it properly done: the rowing is *scaloccio*: "Rarely the condemned receives 10 or 12 lashes without losing power of movement and speech but this does not stop it—20 or 30 lashes for very small offences x x sometimes to 80 or even 100; but from the last the sufferer rarely recovers."

is concerned to oar-vessels of all ages and nations provided reasonable reservation is used and so far as the condition of oarsmen and their life is concerned to oarsmen after they were slaves chained to the thwarts; after about 1300 A D that is. The book does not bear the name of the author but the preface dated 1864 says it was written by Jean Marteilhe de Bergerac who was in the galleys from 1700 to 1713. There is no doubt of the authenticity of the story and we must wonder a man subjected to such savage cruelty had heart to notice details of the construction rowing and management of the vessel. We are concerned only with what is said of the vessels and of life in them, a small part of the book. "An ordinary galley," Bergerac writes,⁷ "Is 150 feet long and 40 feet wide feet of France. They have no between-decks; the deck covers the hold which is 6 feet deep at the side and 7 in the middle of the galley, for the deck is rounded and runs from one end of the ship to the other with a foot of slope from its middle to the side of the galley xx. When a galley is loaded it is all in the water, which enters and leaves the deck because of the slope of the deck. The *coursier* or gangway runs along the middle of the deck and above it forms a long thick trunk and stops the water which without this in a seaway would enter the hold by the openings necessary where the masts are. The trunk forms the combing of the hatchway to go down into the hold. It will be understood perhaps that the rowers on their thwarts and the rest of the crew there have always their feet in the water.⁸ No, for near each thwart for the feet is what is called a *banquette*, a board which may be taken away raised about a foot under which the water on the deck goes. xx For the soldiers and mariners there is a sort of gallery called *bande* along the galley to the right and left. This is at the level of the *coursier*; it is about 2 feet wide all along the outer ends of the thwarts. The soldiers and seamen who live here cannot lie down but are seated on their bags of clothes very uncomfortably. The officers are not much more at their ease when the galley is

⁷ P 430. There are other works about galley-slaves: Souffrances du Sieur Elie sur les Galeres; Torments of Protestant Slaves in the French King's Galleys and Dungeons of Marseilles 1686-1707 Arber 1908; Dern Jours de la Mar à Rames Gravière pp 9, 37; Arch Nav Jal v 1 pp 297-324; Hist Malthe Bosio v 2 p 277, where are rules of the Knights of Malta regarding importance of conserving the strength and health of galley-slaves: see also above p 499 for views of a passenger onboard a galley. See pictures here and pp 78, 81.

⁸ The deck had an opening amidships about 3 feet wide; vertically upward from each side of this extended hatch-combings. Across these at the top were boards. If these were left off or the combing stove the galley would swamp.

at sea, in a word no-one has room to lie down for the hold is filled with provisions and rigging and no-one can lie down there."

"The hold is divided into 6 rooms, to wit: (1) the *gavon* is a little chamber under the poop, it contains only a small bed where the captain lies. (2) The *escandolat* or chamber of office; the captain's provisions are kept there as well as his clothes money furniture⁹ etc. (3) The *compagne*; here are stowed liquid stores, beer wine vinegar sweet water, also lard salted meats stock-fish cheese etc, never butter. (4) The *paillot*; here are the dry stores; biscuit peas beans rice etc. (5) The *taverne*; this is in the center of the galley, it contains wine which the comitre can sell by the pot or pint at a profit, from this chamber is entered the powder magazine of which the master-gunner alone has the key and direction, in the *taverne* are also the sails and tent of the galley. (6) The *Chamber of the Bow* contains the anchor cables and other ropes, in this chamber is the surgeon's box and when at sea the sick lodge here lying very uncomfortably on coils of rope. In winter and when the galley is not armed the sick are lodged at the hospital on shore."

"The rowing benches: A galley has 50 benches 25 on each side. They are 10 feet long and are beams a ½-foot thick placed 4 feet from one another. They are covered with wadding like bags. Each thwart has a piece of hide hanging down to the banquette making thus a series of enclosures between each 2 thwarts and here six slaves are chained. Along the galley's rail but outside the vessel runs a great beam a foot thick xx called the *aposti*. Upon this the oars ship, the larger end extending inboard to the coursier. The oars are 50 feet long, and have about 13 feet inboard of the *aposti* from the *aposti* to the coursier. These 13 feet forming the largest and heaviest end balance the 37 feet of oar outboard of the *aposti*; xx without this it would be impossible to row. xx At the large ends of the oars as they are too large to seize there are wooden handles nailed so that each of the 6 rowers has his place on the oar."¹

Our author continues, "The coursie of the galley is made of 2 thick and strong walls of planks of oak built upward from the deck and extend-

⁹ The French is *batterie de cuisine*, which modern dictionaries give as equivalent to furniture. It is probably a phrase of the modern editor, for utensils for cooking could not have been stored here. In galleys rowed by slaves one or more oars were omitted on one side and the cooking-galley was placed there: but perhaps there was no cooking except in harbor; see p 499 n 2 above.

¹ At their forward and after ends the *aposti* were joined by beams across the ship: this outrigged structure was also called *telaro*: see Glos Naut Jal, *aposti* and *telaro* and pictures mentioned n 7 p 515.

ing from poop to prow.² The 2 walls are $3\frac{1}{2}$ feet apart and thus form a trunk or enclosure where the galley's tent and the bags of clothes of the *chiourme*³ are stowed. The coursie has plank-coverings each rowing-thwart having its own part to clean and to open and close when necessary. Thus covered the coursie forms a gangway in the center of the galley the rowers being to right and left of it: 2 men abreast can hardly walk on it without fear of falling on the thwarts to right and left. I have already said the coursie stops the water and prevents its entering the hold in a sea-way."

We may here examine the surplus floating power of galleys; their most striking feature and one that endured during the years they were used. It was made small so as to diminish cross-section and make them easy to row; they floated awash. This resulted in the body driven through the water being a minimum having in view the weights to be carried, and brought the thole-pins near the water, lessening weight and length of oars and giving better direction to their impulse. From the drawings of row-ships it results that the point in the ship's side where the deck reached it was in a galley of average size 18 to 20 inches above water and the middle of the deck its highest point 24.⁴ This feature separates long-ships by a wide gulf from *nefs*, high-side ships using sails. If the sea came over the rail of a long-ship more rapidly than it ran away through the openings in the side above deck, water would rise above the deck

² The given dimensions do not always hold out: he says the thwarts are 10 feet long; thus the beam of the vessel—of her hull—would be about $23\frac{1}{2}$ feet allowing for the width of the coursie: he says also the inboard part of the oar from the aposti to the coursie was 13 feet, which would make the width from out to out over the aposti $29\frac{1}{2}$ feet: the aposti then was 3 feet outside the main rail of the vessel (this differed of course at different points in the vessel's length); thus the thole on which oars shipped was 3 feet outside the vessel. He says also the vessel's beam was 40 feet, which disagrees with the foregoing: it may be there is error here, for the length he gives the galley, 150 feet, is less than 4 times 40, and the length of row-ships was nearer 7 or 8 times the beam than 4. He says there were 25 thwarts on each side and that they were 4 feet apart; that is the row-chamber was 100 feet long; this agrees with the total length of the galley given, 150 feet. He says the inboard part of the oar was 13 feet and there were 6 men on it; this is 26 inches space for each man; very close but not impossible. The figures will accord if we suppose the 40 feet for width of hull should be 25 or 30.

³ The rowing gang: the word had several variants; *chusma ciurma* etc. It means primarily a crowd, a mob. The *chiourme* were separate from the seamen or mariners who handled the sails and steered.

⁴ See cross-section of galley p 297 v 1 Jal's Arch Nav and p 748 Glos Naut: in the last the drawing is easily understood. A similar figure is on p 92 v 1, Serre's Mar de Guerre. See also picture p 81 above.

until it covered the oarsmen to the middle or neck. The vessel would perhaps turn over; she would sink as the water rose but if her power of flotation exceeded total weights including that of the water on deck would not sink altogether. The oarsmen would be on a submerged vessel. If flotation and weights were right for it the water might run away off the deck and the hull rise. Such craft could not be managed in a seaway. Their speed fell as the sea rose even before they shipped water because of difficulty of rowing; under sail except in smooth water and before the wind they continually shipped seas and every-thing onboard was drenched. The proa of the South Seas, usually deemed the wettest thing that swims, is dry compared to a Mediterranean long-ship.

Jal discusses freeboard and gives the 4 following laws in Middle-Age statute-books as to the depth to which galleys might be loaded: ⁵ (1) "All vessels must show as of old an iron plate to mark the draft." (2) "These marks must be placed just below the *contaut*." ⁶ (3) "The lower edge of the *contaut* shall be taken for the iron if this is wanting." (4) "The water-line shall never be above the lower edge of the *contaut*." He quotes also from a statute of 1330, "These irons shall be affixed by the 2 officers charged with the measurement of galleys."

Of masts the Protestant says, "A galley has 2 masts a large and a small one. The large mast is in the center of the vessel and is 60 feet long, it has no top-mast nor shrouds nor ladders of cord by which to climb it but the Provencal sailors go up with a simple hanging cord so fast a cat could not equal them. A rope attaches the yard or *antenne* to the mast. The yard is twice as long as the mast, 120 feet long. The little mast called *trinquet* is forward at the prow and is 40 feet long, its yard is 80 feet long. There was invented in my time a 3d mast called *artimon* placed when needed near the *guerite* or poop-cabin where live the principal officers. This is 20 feet long and its antenna 40. It is only useful to turn the galley and is rarely used especially since a *rudder* has been invented at Dunkirk to *place at the bow* of the galley. When in combat it is necessary to turn to retire the immense length of a galley makes her slow in turning which gives the enemy a chance to kill many. Sometimes it takes a half-hour to turn. But by this rudder at the bow and the

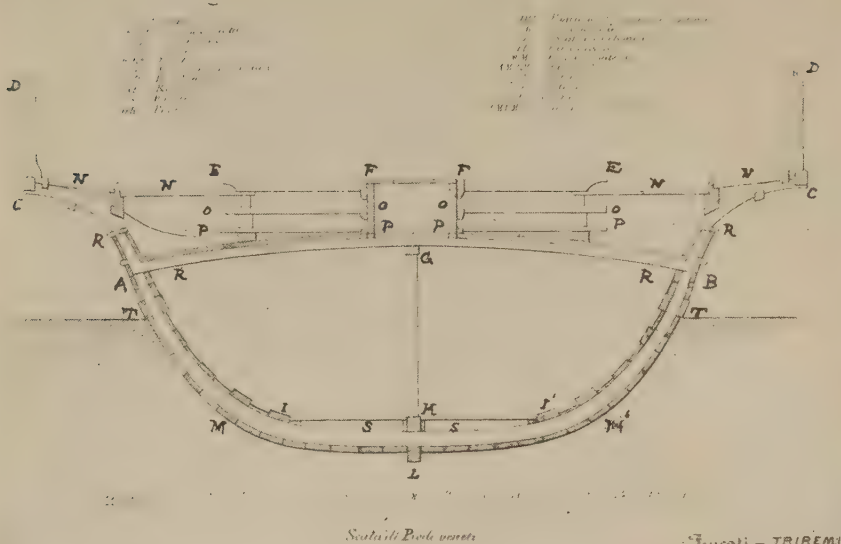
⁵ Arch Nav v 1 p 262. See picture p 514.

⁶ Galleys were built with a *ceint*, whaling piece around the ship just above the normal water-line to strengthen the hull and prevent injury when alongside a dock: from the *ceint* up to the outer edge of the deck was the *contaut*.



Section of galley shown p 25 v 1 pt 4 Raccolta di documenti xx Reale Com Columbiana. The bulwark protecting rowers shows well. The twenty-five oar-ports look as though intended for zenzile rowing, but this cannot be for guns appear and when these were in galley's rowing was scalocco: see also picture p 514.

Spaccato della Galea nella maggior larghezza



Scatola di Porto usata

Fincati - TRIREMI

Cross-section of a scaloccio galley from Fincati's Triremi. As the names on the picture are indistinct they are given below: it is a reconstruction by Fincati. *Spaccato della Galea nella maggior larghezza*, section of a galley of large size; from the context it follows Fincati deems her to be of about the year 1550. AGB, Latta, deck beam; AR-BR, Colli della latta, knee-beams joining beams to sides; CD-CD, Impavesato, Pavesade, fight, protection against fire; FF, Corsia, way fore and aft, it scales 41 inches; EF-EF, Banchi, thwart, rowing bench; OO-OO, Pedagna o punta piedi, for rowers to rise on and from which they threw themselves back on the benches when the oars were in the water; PP-PP, Banchetta, little bench for rowers feet from which they rose to the pedagna; CRP-CRP, Baccalari, knee-beam to carry aposti; N-N, Balestriere, post of soldiers; GH, Puntale, this height scales 5 feet 5 inches at ship's center, 5 feet vertically at her side; IHI, Pagliolo che copre la sentina, platform covering the bilge; H, Paramezzale, step of mast or post; L, Chiglia o columba, keel or hull; II, Parascossole, floor of hold; MM, Piana o matera, bottom of ship; AMRM, Staminali, bends of ship; SS, Sentina, bilge; CC, Posticci, Aposti, in this thole-pins ship. T, Cinta, water-line, bends or wales of ship; TMLMT, Carena o parte immersa, immersed part of hull. This vessel scales in English feet: From thole-pin to its opposite, $23\frac{1}{2}$; Beam on main-deck, $18\frac{1}{3}$; the section is taken presumably at greatest beam, it would grow less as we pass forward or aft while the width across from thole to thole remains the same; see picture at p 81. From banchetta PP where rowers' feet are to water-line, 3 feet 2 inches. From outboard edge of deck to water-line, 2 feet 4 inches. Height CD, impavesato, fight, covering against projectiles, 3 feet 9 inches. Extreme draft of ship, 4 feet 8 inches. Thus when she grounded and the men jumped from her all but tall men would have their chins in the water: also as the point R, the highest of the main hull, is $7\frac{1}{2}$ feet above the bottom of the ship a tall man standing in the water alongside could reach as high as R with the tips of his fingers: he would need help or some appliance to climb onboard.

invention of changing the rowing to row to the rear ⁷ to the poop the guns are always toward the enemy. This manœuvre the change in rowing is accomplished in the wink of the eye by the whistle." ⁸

"The chief comitre who is master of the *chiourme* so the body of chained men are called cruelly drives these unfortunates, remaining always near the poop to receive the captain's orders. Two under-comitres are on the *coursie* xx. These with a rope's-end which they use on the naked backs of the slaves are always attentive to the order of the chief comitre, who when ordered by the captain whistles a certain note on his silver whistle sustained by a chain of the same metal. The under-comitres repeat this with their whistles and the rowers who are ready with the oars in their hands begin to row with so even a cadence that the 150 oars ⁹ fall and enter the water as one. They continue this until the whistle sounds to stop rowing. They must all row together for if an oar rises or falls too soon or late losing the cadence then the rowers in front of the oar that has missed, when they throw themselves back on the thwart break their heads on this oar which has been too slow, also the rowers who missed strike their heads against the oar behind them. The matter is not ended by contusions of the head for the comitre lashes all with great blows so that it is of interest to carefully keep time."

"Represent to yourself 6 chained men naked as the hand seated on a thwart and holding the oar in their hands; they have one foot on the *pedagne* a heavy bar of wood fast to the *banquette* and the other foot lifted and on the thwart in front of them; their bodies stretched out and arms stiff to advance their oar over the bodies of those before them who do the same. Having thus thrust their oar forward they rise and the oar enters the water, then they throw or rather precipitate themselves backward and drop seated on their thwart covered with a sort of cushion. To believe that men could support such work it must be seen. xx True it is a

⁷ The rowing of the Protestant's galley was *scaloccio* several men on each long oar; to row the ship sternward it was necessary for the men to change to the other side of their own oar or all face about and seize the oar which had been behind them: neither would be very simple; see just below, also p 87 above.

⁸ *Jal Arch Nav* v 2 p 130 note says commands were given in ships by whistles in the 13th century. The time for the oarsmen was kept by the flute by *trieraules* or similar means from the beginning.

⁹ There is an error here; he has said there were 50 thwarts 25 on each side; so there were 50 oars. The ship cannot have rowed *zenzile* for this had been disused; if she was so rowed and with 3 men on a thwart there would be 150 oars; 3 at each thwart on each side. See picture here.

galley can navigate only this way and that the *chiourme* must be slaves on whom the *comitres* may exercise their hard authority and make them row not only 1 or 2 hours but 10 or 12. I have myself rowed *à toute force* for 24 hours without a moment's repose. On these occasions the *comitres* and *mariners* put in our mouths a piece of biscuit soaked in wine without our taking our hands from the oars, to prevent our fainting. Then are heard the screams of unhappy men the blood dripping from under the blows of the cord, the clacking of the cords, and the blasphemies of the *comitres* foaming with rage when their galley falls behind and does not go as fast as others. The cries of the captain and principal officers to the *comitres* weary with long flogging to redouble their blows are also heard. When an unfortunate faints at the oar as often happens he is flogged as long as he shows sign of life and when he no longer breathes is thrown into the sea like carrion."

"It must be remembered this very hard rowing is not frequent. The *chiourme* is spared when its whole strength is not necessary as a carter spares his horse. When at sea with favorable wind sail is made and the *chiourme* repose for the sails are managed by the sailors and freemen. Also when the distance from port to port is 24 hours or more they arrange for what is called *quartier*, that is half row for 1½ hours and the other half repose and then all change. It will be understood that 12 oars on each side row; 24 oars for the *quartier* of the poop and 13 oars on each side from the center of the vessel to the prow for the *quartier* of the prow; the two *quartiers* relieve each other in an instant when the whistle blows xx."

"It is not astonishing to see the *comitres* cruel and pitiless, it is the trade to which they have been bred xx. But to see the captains and principal officers men of family and well-bred commanding the *comitres* to strike without pity, it is this I cannot understand and it will seem unheard of to my readers. Once our galley was at Boulogne near Calais where resided the Duke d'Aumont xx. M. de Langeron our captain entertained him onboard and as the sea was smooth proposed they should take a turn at sea. xx We rowed easily to Dover.¹ The Duke remarked he could not see how the *chiourme* so closely packed and with nothing to lie down on could sleep. 'I know,' the captain replied, 'How to make them sleep soundly and will convince you of this by a dose of opium I shall prepare for them.' So he called the *comitre* and ordered him to turn the vessel

¹ From Boulogne to Dover is about 45 miles. The statement just below that the distance rowed was 10 leagues, 30 to 40 miles, is probably accurate.

and return to Boulogne. The wind and tide were contrary and we were 10 leagues from Boulogne. When we were turned the captain ordered full force and *passe-vogue*. This *passe-vogue* is a terrible thing for it doubles the time or cadence of the rowing which wearies more in 1 hour than the ordinary rowing in 4. Besides in the *passe-vogue* the stroke is often missed and then blows of the cord fall like hail. We finally arrived at Boulogne² but so fatigued and harrassed with blows we could hardly move arm or leg. Then the captain ordered the comitre to make the *chiourme* lie down to sleep; this he did by a note of his whistle. The Duke and the officers then dined and after midnight when they rose from the table the captain said to the Duke he wished to show him the effect of the opium and conducted him along the *coursie* where they saw the poor *chiourme* most of them asleep. Others being unable to because of their sufferings pretended to sleep for the captain had so ordered. But what a dreadful spectacle; 6 miserables at each thwart lying formless some on others naked, none had put on their shirts for the most part all bloody their bodies covered with sweat. 'I will show you,' said the captain to the Duke, 'how to awaken them.' Then he ordered the comitre to whistle the reveille. xx Hardly one could sit up so stiff were their legs and bodies and it was with many blows they were made to sit up making a thousand ridiculous and painful postures."

The Protestant tells this tale:³ Some lords and ladies came onboard and after walking over the vessel the *chiourme* dressed in their best and the vessel be-flagged the party is seated in *fauteuils* at the poop: the captain gives directions to the comitre and upon successive whistles the *chiourme* remove one at a time their caps coats shirts, then crouch down on the thwarts so they cannot be seen, then sit up and raise one finger, then the arm, then all open the mouth; while the visitors look on.

He tells of masts and sails guns the food-ration; "Each mast of a galley has one sail but there are several sails greater or smaller to be used according to the wind. xx To make sail the antenna is lowered down on the thwarts and the slaves fasten the sail to it and if the wind is not too strong the antenna is hoisted to the mast-head. xx The sail xx has the form of a pigeon's wing, xx all sails being triangles or three-pointed. When the wind is strong there would be danger in hoisting the antenna

² There is nothing to show how long it took: considering the distance, it could not have been less than 5 hours.

³ P 512.

when the sail is fast to it xx. To avoid this after the sail is fast to the antenna it is rolled up and fastened to the antenna with little cords; xx after hoisting the sail is pulled down strongly the little cords break and the sail is spread in an eye-wink. The sailors never go on the antenna to fasten and unfasten the sail; it must always be lowered. In combat the antennæ are fastened by several ropes and even chains for if a bullet cut the rope of a size of 6 inches which fastens the antenna to the mast it would fall on the galley and perhaps sink her or at least injure many persons."

"A galley carries 5 bronze cannon all at the bow. The principal gun is called the *coursier*; xx it is enclosed as in a box in the *coursie* and has a 36-pound ball. It rests in a slide-way of strong planks nailed inside the edges of the *coursie*." This gun recoiled as far as the mast in its slide-way and was hauled forward again by tackles. It was usually a *culverin* a gun of high-power, long and with small bore. Its mounting allowed no horizontal movement but did permit vertical train, the gun being on trunnions with a quoin under its breech. Two guns were mounted on each side of the *coursier*, a 24-pounder and 18-pounder; these had no recoil.

Next is given the food-ration and pay of persons in a galley: "The *chiourme* to the number of 300 have each 26 ounces of biscuit and 4 ounces of beans per day:"⁴ but nothing else apparently, while others are well fed; the "Six principal officers," receive each week, "Seven pots of wine measure of Paris," among other things.

"An armed galley," the narrative continues, "Has always 2 *chaloupes* one large and one small. The large one called *caïque* has a crew of 10 freemen who each pull his own oar and a *timonier* to steer. This *chaloupe* serves to raise the anchor when the galley is about to sail also to bring off fresh water and other heavy weights. The small *chaloupe* is called the *canot*; she has 8 freemen to row her and a *timonier*. She is entirely for the use of the principal officers. When about to leave port these 2 *chaloupes* are embarked in the galley one to starboard and one to port, being hoisted with tackles supplied with pulleys. They are placed on wood frames called gallows 6 feet higher than the thwarts they cover thus taking no space and preventing no manœuvre for the rowers under these row as well as others. In communicating with another vessel at sea the *canot* is launched in a moment or even the *caïque*. When the anchor is let go they are both launched and fastened at the stern of the galley;

⁴ See Hist Malthe Bosio v 2 p 277 as to ration of slaves of Knights of Malta.

always with a good guard for fear the slaves principally the Turks, who are always un-chained and have only an iron ring around the leg night and day might thus escape. It is permitted even to those of the crew to go into the chaloupes to smoke for in the galleys this is forbidden under pain of having the nose and ears cut off. The principal officers even and the captain may not smoke in the galley xx." Smoking was forbidden in English ships about the same time; see above p 310.

"Each *forcat* receives every year 2 cloth shirts xx 2 drawers of the same, which are made without legs and like a woman's petticoat for it must be put on over the head because of the chain. This thus made like a petticoat descends to the knees. Then a pair of stockings made of heavy red material and no shoes. But when employed onshore in the winter the *argousin* furnishes them shoes which he takes from them when they return onboard. Every 2 years they receive a coat of heavy red stuff. A skilful tailor is not necessary to make these. They are made of a piece of material doubled, $\frac{1}{2}$ for the front and $\frac{1}{2}$ for the rear and above a slit for the head xx; they have sleeves reaching to the elbow. xx Every year the slaves have a short cap of red wool for it must not cover the ears. They receive also every 2 years a long cloak made like a dressing-gown and reaching to the heels. This has a hood xx and is the best garment of a *forcat* for it serves as a mattress and cover at night and to wrap himself in during the day."

There follow remarks on employment of galley-slaves during the winter when the galley is laid up in port and a dissertation on the usefulness of galleys compared with sailing-vessels of war; the general conclusion of which last is they cost a great deal and are of little use especially in the Ocean.⁵ Service as officers in galleys provided a way for poor noble persons to gain a livelihood in an easy and luxurious way and the Royal Galley Corps was not abolished in France until 1748.⁶

PUNISHMENTS IN SHIPS.

Punishments in early days were very severe and into this *Jal* goes at length:⁷ the *bouline*, forcing a malefactor to run the gauntlet between 2 lines of men each having a whip or rod, is mentioned in 1274; and the

⁵ In the *Torments of Protestant Slaves* listed n 7 p 515 above, written about 1710 we read, "When an enemy's ship is becalmed a galley xx may attack that ship fore or aft to avoid her broadsides xx. A ship needs but a little wind to make nothing of over-throwing 5 or 6 galleys."

⁶ *Gravière Dern Jours Mars à Rames* p 115.

⁷ *Arch Nav* v 2 pp 107-19.

cale, keel-hauling we call it, is still older and seems to have been practiced as late as 1700.⁸ There were many ways of carrying out the last; the prisoner being as a rule suspended from a yard-arm and dropped into the water as many times as the sentence required, though sometimes by a rope passing under the ship hauled under the keel and up the other side. Lindsay gives the substance of the oldest maritime laws of England, founded on the *Roles d'Oleron*.⁹ There are rules in these which cannot but amaze those of modern days; of these the most remarkable though seemingly universal was that captains were required to govern the movement of ships in conformity to dictates of the majority of the crew and merchants onboard called by him in council; and that the crew had a right of asylum in the castle forward where they lived: Lindsay gives a law saying the captain might call a seaman opprobrious names, to which the last is advised to submit and hide himself in the forecastle; but if the captain follows the seaman may stand on his rights for the captain, "Ought not to pass into the forecastle after him."

A code of 1354 of Peter IV King of Aragon has been preserved.¹ One rule reads, "Any man in the galley who flings out the word at the comitre shall lose his tongue without pardon. But if he assaults him he shall be hung at the lateen yard without pardon:" also, "No man for no fault shall lose hand or foot for afterwards he is worth nothing and better dead than alive. It is better to flog him letting him run through lines of men with whips or lose his tongue or ears according to his fault."

EARLY COMBATS UNDER SAILS.

We have reached days when ships fought under sails, though in the Ocean they have always fought thus for the most part. But by 1600 to 1700 long-ships disappeared, for round-ships had become so capable because of improved rig they could be depended on even in narrow waters. It is not intended to go into the handling of sailing-ships in action nor that of steamships but the accounts of 2 early fights not often referred to may be inserted. The first was in a voyage home from the East Indies in 1583 and by Linschoten; he says² on his ship being attacked by English near the Azores, "When we shot off a piece we had at least an hour's work

⁸ *Jal Glos Naut* word *cale*.

⁹ *Hist Merch Shipping* v 1 pp 379-94; and appendix 2 same v: see also *Pardessus* cited p 70 n 6 above.

¹ *Orden Arm Nav Aragon 1354* Capmany Madrid pp 9, 12.

² *Hakl* pp 268-9 v 2. See below pp 645 and foll'g for other things by Linschoten.

to lade it again whereby we had so great a noise and cry in the ship as if we had been cast away whereat the English-men themselves began to mock us and with a thousand jesting words called to us xx." There was little harm done to either side, "The English with their flags openly displayed came lustily toward us sounding their trumpets and sailed at the least 3 times about us beating us with musket and caliver and some great pieces, they did us little hurt in the body of the ships but spoiled our ropes and sails, in the end the English-men xx left us." The other case is an English ship fighting a Spaniard in 1594;³ for 2 days the ship fought, "A great armatho of the King of Spain," without damage except, "One hurt with a bullett, which was most strange seeing there was no man in the ship but stood in the face of the enemy without either fights or nettings. After our 4 pieces of ordnance which was all we could use the rest being stowed in the hold and 15 small shot had spent all the good powder we had which was 9 barrells for the rest was so wet with the water that came in at the bows that it would rather fly out at the touch-hole than carry forth the bullett; and after we had so beaten her with small and great shot as by our seamen the like was never seen we for want of powder left our enemy to the mercy of the ocean."

THE ROUND-SHIP TOOK TO OPEN WATER WHILE LONG-SHIPS CLUNG TO THE LAND: LIFE IN THE TWO CONTRASTED.

As the long-ship is disappearing it should be remembered how different she was and how different life in her was from that in round-ships. The last made long voyages before the day of Dias Columbus and Magellan. For centuries round-ships differed little in sea-worthiness appearance and rig from the trading-ships the Greeks found plying in the Mediterranean when they wandered down into the Grecian peninsula about 2000 B C. It is incorrectly asserted sometimes that until about 1500 ships never left the land. Nothing can be more misleading. Dias the first of the great voyagers went in a round-ship and his voyage was long and in the widest ocean in the world, that stretching around the earth in high southern latitude. A few years later round-ships were improved and in the simplest way imaginable; in that their sail area was broken into many parts. Instead of having one mast and one sail on this round-ships had 2 or 3 masts and on each 3 or 4 sails. Several yards on each mast made sails stand flatter; the ship lay nearer the wind and was sure of

³ Voy Dudley xx to W Indies 1594-95 Hakl p 26.

tacking. There were other improvements but the principal one was the sail area was broken into parts. This made ships more weatherly and better able to carry sail in bad weather and has gone on until our day, for double topsails and double top-gallant sails came in during the life of those now living. The alteration was adopted slowly by crack ships and ships-of-war, for these have large crews and a reputation for fashion to maintain.

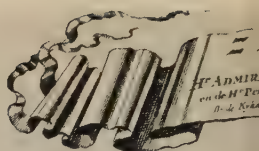
The row-ship clung to the shore. She was built for this and unfitted to take the open sea, being an outcome of social conditions and the sea in which used. We have her story for 2000 years during which period she grew larger but was otherwise unchanged. Although she saw round-ships steer across wide arms of the sea she never followed. Men were a few hours or a fraction of a day in row-ships but weeks or months in round-ships. When Admiral Nelson landed in England in 1805 after following a French fleet east the length of Mediterranean then back west and across the Atlantic to the West Indies then east again to the Strait of Gibraltar, he wrote on going to England, "I went ashore for the first time since June 16, 1803 and from having set my foot out of the Victory 2 years wanting 10 days."⁴ The crews of Nelson's ships very numerous and living in contracted space were kept in good health; about the date just given he wrote, "We have neither sick nor have had in the fleet. Neither this ship or Superb which is come with me have one man to send to the hospital."⁵ Captains of Nelson's time were not the first to keep a ship's-company well for a long interval for Captain Cook had already done this.⁶ Nelson's friend and comrade Collingwood had long periods in ships and hard service. He was married at 40 in 1790 and had 2 daughters born 1792 and 93. In 1794 he commanded a ship-of-the-line in the Battle of the First of June and the next year went to the Mediterranean. He was at home for a short period in 1801 when the Peace of Amiens was made and wrote 10 years later, his death being near, "Since 1793 I have been only 1 year at home. To my own children I am scarcely known xx." He died March 7, 1810 the day after leaving Port Mahon in his flag-ship for England. When death became imminent the ship's physicians decided he

⁴ Disp and Letters Nelson Nicolas p 475 v 6. The letter is dated July 20, 1805.

⁵ Disp v 7 p 12. The letter is dated Aug 18, 1805. The Superb was the only ship with Nelson's the Victory on reaching England: in passing north from Gibraltar he left the rest with Cornwallis who held the blockade off Brest winter and summer for years.

⁶ Below pp 656-57.

- 1. Kap't Pieter de Sijder
- 2. Kap't Lohse Willem
- 3. Schouten Lacht de Kierster
- 4. Kap't J. van der Meer
- 5. George Lattin
- 6. Kap't J. van der Meer
- 7. Kap't J. van der Meer
- 8. Kap't Thomas Groot
- 9. Kap't J. van der Meer
- 10. Kap't J. van der Meer
- 11. Kap't J. van der Meer
- 12. Kap't J. van der Meer
- 13. Kap't J. van der Meer
- 14. Kap't J. van der Meer
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- 22. Kap't J. van der Meer
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- 42. Kap't J. van der Meer
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This is battle of August 21, 1673 between fleets under Ruiter and Prince Rupert and Count d'Estrees: the original marked and others unmarked: there were probably 200 craft present. No doubt the picture faithfully represents view. It will be noted the ships have three masts, two with square course topsail and topgallant sails, and one with lateen which are among the



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688. Fr trans Brandt's Life of Ruiter and page 858 Dutch ed. In these the ships are identified: there are 115 and much may be discovered by the positions of the ships though a magnifying glass is necessary to read the print. square sail above this. None have jibs, and sprit-sails and topgallant sails are furled. The small vessels, some of are otherwise rigged.

must go home his earlier representations to the admiralty of failing health having brought forth nothing.⁷

So different is all this from the ways of war-ships of ancient and mediæval day in the Mediterranean that it calls for effort to realize it. We have now entered upon other things and no longer are ships cut off as 100 or even 75 years ago. The so-called Period of Sails 1550 to 1850 was an important one; and seamen of the day served long apprenticeship and remained long in service. Nelson went to sea when 12 and his 35 years in service were full of incident. Collingwood was 11 and he too was present in many battles. Ruiter the great Dutch admiral went to sea when 11 and was killed on the deck of his ship when 70. He was in more than 40 combats; in 15 general actions in 7 of which he was commander-in-chief and in 5 second-in-command.⁸ No other admiral had as much service as Ruiter; he was at sea almost continuously from the age of 11 until 70 but had time to marry 3 times and have a number of children. His last wife Anna van Gelder survived him and to her his biographer commended his book. Ruiter was of pure and lofty character and served long and well. The lives of his associates were as full and stirring: Peter Hein born 1570 and killed on the deck of a ship in 1629 captured the Spanish Plate Fleet with a vast treasure in 1628 being lieutenant-admiral. He is said to have once been chained to an oar in a Barbary corsair. Tromp went to sea at 9; was captured when 11 by a pirate and forced to serve as cabin boy for 3 years when he escaped. He was killed on the deck of a ship 1653.

Dutch fleets of the day practiced military evolutions: in the *Life of Ruiter* we read, "Very often military exercises were conducted by the fleet and of a squadron entire against another as though the enemy was

⁷ Corresp Collingwood Collingwood New York 1829 pp 18, 19, 26, 28, 69, etc. Collingwood commanded a detachment of seamen in the attack on Bunker Hill: besides the biographies and letters of this period there is Gill's *Naval Mutinies of 1797* well worth reading.

⁸ *Vie de Ruiter* xx Trad Brandt 1698 p 696. This seems a duplicate of the Dutch ed 1686. The plates in the two are identical and represent battles of the day. They are very like those in Hoste's *Art des Armées Navales*, 1698. There is an English *Life of Ruiter* by Grinnell-Milne 1897 and another of 1677 but rare seemingly. The N Y Public Library has copy of a Letter from the Heer Lt—Adm de Ruiter to the States—General Giving an Acct of the Late Engagement Between Him and the French Fleet on the Coast of Sicily Trans out of the Dutch as It Was Printed at the Hague 1676. This is called the Battle of Stromboli, Jan 8, 1676. In another action 3 months later and near by off Agosta Ruiter was killed never before having been wounded. In both these actions Duquesne commanded the enemy fleet. See picture here.

in sight. xx In these simulated movements attempts to board were made, to go about by signal, they tried to gain the wind and other advantages xx." When his fleet was off Goree in 1672 on approach of English ships of war,⁹ "They sent below a number of women and children who had come to visit their husbands and fathers because there was not time to land them and the cannons were prepared. Some women begged to be left on deck as they wished to aid; this they did effectively." Perhaps it means in preparing the ships for there was apparently no fighting, a fog coming up. It would not have been the only time women fought with arms in their hands in these days.

Dutch seamen penetrated to all parts of the world, exploring colonizing trading, and Holland controls now an empire in the Far East won by them. They played an heroic part when resisting the attempt of Spain to impose the Inquisition: men and women driven from home and their lives threatened took to the water and with ships fought the troops of Alva in many a combat. They called themselves Beggars of the Sea and their story is full of romance and interest in which the most remarkable event is their carrying the ships by aid of a high tide and onshore wind over land to the besieged city of Leyden, driving off the Spanish and relieving the famished citizens.¹

⁹ P 539 Life.

¹ See Motley's Rise of the Dutch Republic; Gravière's Gueux de Mer.

CHAPTER XI.

Round-Ships From 1450 Until Now.

This is the period of the voyages across the Atlantic to America and around the Horn and Good Hope to meet in the East and define the shape of the earth; but while appreciating these to the full it must not be forgotten there were in earlier days voyages as wonderful. Many of these have been recounted and there are no doubt a multitude of others which have left little or no trace: it has not been generally noticed though of much interest to Americans that natives of Africa were found in this continent when the Spanish first came here, coming perhaps, who can say the contrary, as Puritans and Huguenots came, to escape oppression at home: Peter Martyr born 1457 and died 1526 wrote of Quarequa in the Isthmus of Darien,² "The Spaniards found negro slaves in this province xx. It is thought that negro pirates of Ethiopia established themselves after the wreck of their ships in these mountains. The natives of Quarequa carry on incessant war with these negroes; massacre or slavery is the alternate fortune of the 2 peoples."

Peter Martyr was an interesting gossip and many of the great men and events of the day are mentioned in his book. He had Cabot Vespuccius and others at his table to hear them talk, writing down what they said; he shows that ships in early days had women aboard³ and tells of the Gulf Stream in about 1515 hardly 20 years after Columbus saw Hispaniola and long before there was means to determine longitude except by dead-reckoning, by which of course the drift of a current is not detected. He wrote regarding this,⁴ "The ocean currents in these regions run toward the west. Thus I find myself uncertain when asked where these waters go xx and how it happens that the west is not consequently overwhelmed by the waters and the east emptied;" then he goes on about a strait, "To the west of Cuba which would conduct these raging waters to the east from whence they would return to the west again." Martyr derived this knowledge from those who had been west in ships and that they should

² Orbe Nova P Martyr D' Anghiera trans MacNutt 1912 p 286 v 1.

³ Pp 401-2 v 1.

⁴ P 346 v 1. The strait he mentions is now called Florida Channel; here the velocity of the Stream is great and its direction east of north.

have observed the current so early shows how keen was their insight and accurate their scientific habit. I do not think the fact that this movement was so early noted has been recorded by any-one but this pleasant and intelligent churchman. It should be remembered that it was still uncertain whether there was a passage to the East through the land lying west of the West Indies through which the great flow might pass.

DIAS COLUMBUS DA GAMA MAGELLAN.

These are the men who first occur to us in regard to the Great Voyages. They sailed respectively in 1487, 1492, 1497, and 1519, and we have the stories written by men who went in the ships. Because written by or for those who knew how ships were rigged and handled and their way found the seaman's art comes before us almost finished. No longer is it necessary to pick up here a fragment and there another; what could be done at sea was done as is plain to him who runs. The art is not without mystery and calls often for intuition higher than learning: it did not spring into life when Dias sailed nor in the interval between his sailing and that of Magellan, 30 years. We do not know how long before it took origin but there is more evidence to show the interval was 2500 years than that it was not so long.

BARTHOLOMEU DIAS.

Bartholomeu Dias a cavalier of the House of the King of Portugal and seaman of experience sailed from the Tagus August 1487⁶ with 2 vessels rated at 50 tons and a smaller one to carry extra stores, all probably fore-and-aft rigged: Barros says in the place cited, "They armed 2 *navios* of 50 tons each and one *naveta* to carry extra stores because upon many occasions navios had failed in discovering for want of this." The larger vessels could not have been more than 60 feet long and must have been decked which all Columbus' ships were not, for men could not have lived during the months Dias was off the Cape unless some place in the ships was sheltered. Even so what must life below-deck have been

⁶ Barros Asia dec 1 liv 3 cap 4: Castanheda Hist India, French trans Grouchy cap 1: Correa Lendas da India cap 1. The ed of Barros used is the re-print Lisbon 1778; the Castanheda is in French; there is a part of Correa in Eng in Hakl called Three Voy da Gama. Both Correa and Castanheda are earlier than Barros and no-one of the 3 were seamen though Correa went to India in 1514 and remained there material time. Of the 3 Barros only has not been translated; why it is hard to say for his work is the fullest. There is an excellent article by Ravenstein v 16 July-Dec 1900 Geog Jour incl Roy Geog Soc pp 625-55 called Voy Diogo Cao and Bartholomeu Dias 1482-88.

when hatches were battened down and seas going clear over the little craft, while lights burned blue if indeed there were any and cooking was out of the question. Correa says Dias' ships were *caravels*; ⁷ but this while it indicates they were not large does not show their rig for there were *caraveles redondas* and *caraveles latinas*, square and fore-and-aft rigged caravels. This author almost co-temporary says the King was told that in future, "He should send *navios altos*, high ships, which could go out in the sea; *navios grandes*, large ships, which could withstand the heavy seas." Such ships were built by Dias when he returned and used by Gama. By *navio alto* was meant no doubt a ship of high freeboard.

Dias was to discover the way by sea to the Indies. He knew the direction in which the Cape lay and where the Indies lay and in what direction; but how far the Cape was he did not know, for though many had preceded him south none had reached the Cape; though Cao who immediately preceded him came near doing so. Barros writes of conferences at which Dias may have been present,⁸ "Then the King with the cosmographers of the kingdom took the general map of Ptolemy depicting all Africa and the monuments erected on that coast by his own discoverers to a distance of 250 leagues xxx. It was determined to send immediately this year 1486 ships by sea and travellers by land to see the end of these things he so greatly hoped."⁹ Dias reached in a time which cannot be discovered a harbor on the west coast of Africa he called *Angra das Voltas*, Bay of Tacks: "Here," writes Barros,¹ "Bartholomeu Dias was detained 5 days by the wind which prevented the ships from going on, and that bay is in 29° on the side of the south. Leaving there on the tack to seaward they ran 13 days with *velas a meio mastro*—sails at half mast; and as the vessels were small and the weather bad and cold the crews suffered greatly."

They sailed from Portugal in August and probably reached 29°S in December when a south wind would cause suffering among men always wet and living on poor and perhaps spoiled food in considerable part uncooked. In latitude 29° S the ships were about 500 miles from the

⁷ Cap 2.

⁸ Asia, 1, 3, 4.

⁹ The references to Ptolemy's maps of 1400 years before are frequent until much later: here must be meant that on a map called of Ptolemy correction had been made showing a southern extremity of Africa which the maps of the Geographer did not show; on such a map the extreme south positions of navigators had been marked: Bunbury v 2 p 578 for Ptolemy's map.

¹ Asia, 1, 3, 4.

Cape. When they ran 13 days with sails at half mast, the yards either square or lateen were hoisted half-way and bonnets unlaced from the foot of the sails; or perhaps the sails reefed on the foot. The Cape of Good Hope is 35° S and in 13 days running under short canvas the ships must have made about 1300 miles, which from 29° would put them in 50° S. If they reached 45° they were several hundred miles south of the Cape. Here the gale broke and the squadron steered north and east and upon making land communicated with it.

The men were exhausted and Barros says Dias, "As obliged by his office and the prescript² of the King in order to satisfy the complaints of so many landed with the captains officers and principal seamen x x." These decided it was for better service of the King the ships should return to Portugal but Dias persuaded them to allow him to go on a few days. It is not recorded where this first landing was but at the end of the few days they saw a river which goes on modern maps by the name then given it: "Joao Infante captain of the ship S Panteleao saw the land first, it was called Infante" Barros says. It is 32° S, 700 miles east and north of the Cape: from it they steered for Portugal. Dias called the great Cape, off which he was drowned 15 years later when his ship, one of Cabral's fleet, foundered with loss of all onboard, *Cabo Tormentoso*, but the King changed the name to *Cabo de Boa Esperanca*: so Barros says but the tale is doubted.³

An account of Dias' voyage was written by Columbus in a copy of the *Imago Mundi* of Pierre d'Ailly: it reads, "Note that in December of this year 1488 there landed at Lisbon Bartholomeu Dias commander of 3 caravels whom the King of Portugal had sent to Guinea to seek out the land and who reported he had sailed 600 leagues beyond the furthest reached hitherto, that is 450 leagues to the south and then 150 leagues to the north, as far as a cape named by him the Cape of Good Hope which

² *Regimento* in Barros.

³ The quotations are from Barros, 1, 3, 4. Conferences were usual in ships; yet Magellan and Drake executed those who resisted them and Gama when he passed the place Dias landed for conference put his pilots in irons, and gathering their instruments flung them into the sea when they tried to induce him to put back: the last is Correa's story and will be found p 62 *Three Voy Gama Hakl*; it is often discredited. It is difficult to understand the measure of the responsibility of commanders in these days: when Albuquerque reached the Cape Verde Islands on the way to India in 1503 he called a council to decide whether to proceed along the coast of Africa or south and west across the trade wind into mid-ocean, as Gama had gone 6 years before and as is correct to go: the Council decided they should follow the latter route; Gama's *First Voy Hakl* p 191.

cape we judge to be in Agisimba; its latitude as determined by the astrolabe being 45° and its distance from Lisbon 3100 leagues. This voyage Dias depicted and described from league to league on a chart so that he might show it to the King at all of which I was present.”⁴

Barros states 4 latitudes and several courses and distances from Dias’ record, the former of which are very close and all bear critical comparison. The courses must have come from compasses and the distances were probably estimated by observation of the water alongside, for it is unlikely an instrument for measuring speed was used, though necessary an elapsed time should be measured or judged. There were 2 ways by which latitude could be determined by observation; longitude by observation was out of the question; both latitude and longitude was kept by dead-reckoning. The 2 ways to observe for latitude were by the south pole-star the Southern Cross⁵ and meridian altitude of sun moon or star. There can be little doubt Dias observed for latitude by meridian altitudes, probably of the sun. This requires the declination, angle from the equator, to be known in advance, and we know the method was familiar before Dias’ day and tables of declination existed:⁶ Azurara who preceded Dias mentions, “The great knowledge in cosmographers concerning the movements of the heavenly bodies.”⁷

LATITUDE BY OBSERVATION.

That obtaining latitude by meridian altitude was understood and that tables of declination existed is beyond doubt, but Barros who wrote in 1539 states that when Gama was to sail 3 astronomers were appointed by the King to investigate the way to guide ships at sea; “In the time of Prince Henry,” he says,⁸ “All navigation of mariners was along the coast.

⁴ P 639 Ravenstein’s art cited n 6 p 530 above: facsimile copy of Columbus’ writing is in *Raccolta dei Documenti etc Columbiana* pt 1 v 3 and Ravenstein says the original of the quotation above has been examined by experts and pronounced Columbus’ writing. Agisimba was on the map of Ptolemy on the east of Africa in latitude 20° S. The lat Columbus gives for the Cape, 45° S, is perhaps Dias’ report of his furthest south; the Cape is 35° S. The distance stated to the Cape from Lisbon, 3100 leagues, is too great: following the coast of Africa it is about 6000 geog miles; Dias following the route his predecessors had gone coasted this shore but as we shall presently see perceived and taught the better route, the one by which ships go now. See below pp 542–4 for other marginal notes by Columbus in the *Imago Mundi*.

⁵ Below p 622 n 3.

⁶ Above p 239.

⁷ *Disc and Conq Guinea* Hakl v 1 p 13: Azurara wrote before 1453 nearly 50 years before Dias’ voyage.

⁸ *Asia*, 1, 4, 2; p 282 v 1 ed of 1778; Ravenstein Behaim and His Globe p 12. Prince Henry—the Navigator as commonly called—died 1460.

xxx But now it is necessary to navigate to discover to lose sight of the coast and engulf the ship in the sea x x." The 3 astronomers were called *Junta dos Mathematicos*, Commission of Mathematicians. The junta Barros goes on, "Found the method of navigating by the altitude of the sun and made tables of the declination of the sun now used by navigators x x. Da Gama with his pilots was prompt to take the altitude of the sun by this method xx." It cannot be that seamen learned the method by meridian altitude in 1497 from the labors of the junta. In Azurara referred to 2d note preceding we read, "Up to this era of 1446 xx 51 caravels had passed beyond Cape Bojador 450 leagues.⁹ And what was on the chart with respect to this coast was not true x x but what is now placed on the charts was a matter witnessed by the eye. x x x They had it marked on the charts that the shore was so shallow that at the distance of a league from the land there was only a fathom of water." There is an important tale in Azurara: In 1446 the captain of a ship south on the west coast of Africa was killed and as there were no pilots onboard the ship was wandering; Azurara writes, "A sailor lad in whom they were all putting their hope confessed openly his scant knowledge saying he knew not how to direct the course of a ship or to work at anything of that kind in such wise as to be serviceable, but only if directed by another he would do what he could x x. He bade the seamen steer directly to the north declining to the east namely to the wind called N E. Now this youth in him God put such grace that for 2 months together he directed the course of that ship but all were doubtful what their end would be for in all those 2 months they never caught sight of land:" they reached Portugal then.¹ The ship was on the high seas 60 days out of sight of land. There is another story showing Portuguese ships engulfed themselves in the sea as Barros has it before the day of the Junta. The Navigator Prince Henry in 1434 was exhorting Gil Eannes to pass Cape Bojador and said to him, "I would not blame you but you tell me only the opinion of 4 mariners who come but from the Flanders trade or from some other ports that are very commonly sailed to and know nothing of the needle or sailing-chart.

⁹ Bojador is 26°N; 450 leagues beyond taking the league at 3 miles is Cape Palmas 4°N where the coast turns sharp eastward. Azurara says 51 caravels had gone so far south before the death of Prince Henry as to sink the north pole-star when lat could be found only by merid altitude.

¹ Pp 236, 230, 256, v 2 Azurara Hakl.

Go forth then and heed none of their words x x." ² Eannes went, passed the cape, "Ordered the boat to be put out" and went onshore. Azurara shows the Portuguese took to the open sea and passed so far south as to lose the pole-star before the day of the Junta dos Mathematicos.³

DIAS BUILDS SHIPS SUITABLE FOR DA GAMA.

Upon return to Portugal Dias was ordered by the King to build ships to go another voyage and these were taken by Gama 10 years later. Barros writes,⁴ "Since Bartholomeu Diaz saw the discovery of the Cape of Good Hope he was ordered to cut wood for the vessels of Gama's voyage and the King ordered him to finish them as he knew would be suitable to withstand the fury of the sea in the latitude of the Cape which mariners began to believe of fabulous danger as of old they believed of Cape Bojador. The preparing of these vessels was given to Dias. He was to *accompany Gama to the latitude which was necessary to show him the route*,⁵ and so the King made Dias captain of one of the ships that went to S Jorge de la Mina."

DA GAMA'S FIRST VOYAGE; DIAS DIRECTS HIM HOW TO GO.

"The company of this fortunate voyage," writes Barros following the last citation, "Seamen and soldiers was 170 persons and the 3 vessels more or less 100 to 120 tons x x. The 4 vessels ⁶ started Bartholomeu Dias in company in the ship going to Mina x x. They arrived in 13 days x x at the Cape Verde Islands x x. After leaving these islands Dias accompanied them *to put them in the way*, but Da Gama did not go to Mina. The first land at which Da Gama touched before arriving at the Cape of Good Hope was the bay called St. Helena being five months since leaving Lisbon." The passage shows that when Barros wrote the

² Azurara p 33 v 1. Beazely trans of Azurara says Intro v 2 p CXII caravels of the day were 90 ft long and 24 beam. From several passages in Azurara it results that their boats were hoisted not towed.

³ The measurement of the earth's circumference made at sea by Columbus before his first voyage shows he went into the open sea without disquietude, below p 542.

⁴ Asia, I, 4, 1-2; v 1 pp 270, 279 ed 1778.

⁵ This word in Barros is *derrota*. Ravenstein whose authority is undoubted writes Gama, "Trusted implicitly to the charts and sailing directions of Dias and perhaps of Pero de Covilhao," First Voy Gama Hakl p XVIII. Covilhao did not contribute knowledge how to go to the Cape for he went to the East by land and the Red Sea: Dias on his first voyage followed the coast of Africa south and perceived the correct way and taught it to Gama: this is returned to presently.

⁶ There was a store-ship.

seafaring world believed Dias had, upon observing the absence of regular wind near the coast of Africa and direction of the N E and S E trade winds, discovered the correct route to the Cape of Good Hope. It is far from obvious: a long detour, as a glance at the map will show.

Reconstructions of Da Gama's ships have been made by Portuguese navy officers. The 2 larger were 84 feet long 28 beam 17 deep, draft $7\frac{1}{2}$ feet forward and $5\frac{1}{2}$ aft, and of 178 tons burden.⁷ The draft is very little; the vessels must have been very lively in a seaway. The Pelican in which Drake sailed around the world in 1577 was rated 100 tons and drew 13 feet; "Our ship requireth 13 foot water to make her float."⁸ There were ships of much greater size and draft at earlier dates: Marco Polo 200 years before Dias being in a Chinese ship in the Strait of Malacca says, "Throughout this distance there is but 4 paces of water so that great ships in passing this channel have to lift their rudders for they draw as much water as that;"⁹ the draft of these was 20 feet. Once the seas were known and trading began ships going east were very large: *carracks* they were called and many carried 1000 persons. A *carraca* of 1250 tons appears in an armada of July 1493.¹ Dias built the ships for Da Gama more than twice the tonnage of the vessels with which he had passed the Cape and square-rigged; they had 3 masts with course and topsail on the 2 forward masts and a lateen-sail on the after one. He did the world a great service by showing how to utilize the N E and S E trade wind in going from Europe to the Cape of Good Hope, for in earlier times ships followed the coast of Africa keeping in a region of light winds and squalls and land- and sea-breezes where the ship made slow progress and the men contracted illness. In going south he followed the coast² but saw the best route was to keep east in the N E trade and cross the equator at such a point as to take the S E trade on what seamen call an easy bow-line—free enough to give the ship good speed—and go thus about S S W as far south as this wind holds, to 25° or 30° S. At this point where the trade fails and westerly winds make, the ship changes direction a right angle and with good fortune steers east with favoring gales to the Cape of Good Hope. Neither Dias nor Da Gama knew of the existence of South

⁷ Three Voys Da Gama Hakl pp 159–69; drawings are given.

⁸ World Encomp by Drake Hakl pp 6, 156.

⁹ Cordier's Yule's M Polo v 2 p 280, next p is stated the Italian pace is 5 feet.

¹ Navarrete v 2 p 81.

² The story of Dias' voyage is in Barros, 1, 3, 4; pp 184–190 v 1 ed 1778: as he landed negroes in Africa he followed the land.

America and were thus unaware of the danger of being driven by the S E trade so far west as to be unable to weather this coast. Dias saw this land a few years after Da Gama was near it and must have then realized the place to cross the equator and enter the S E trade needs to be narrowly prescribed; that ships must cross far enough east was soon appreciated and the place sailing-ships still cross selected.

THE TRADES.

The trade-winds were known to European seamen before 1450. People who lived in their region must have known them and believed probably winds were so everywhere. European seamen had known of them before the day of Dias: Marco Polo knew of them or the monsoons 200 years before though he experienced them only near the coast of Asia. European seamen had been south on the coast of Africa 100 years before Dias' time and although those who kept near that continent may have been unaware of them those who had been to the Cape Verdes—15° N—must have experienced them for the wind is always in the north-east there. Columbus knew them for he used them correctly from the first; he tells that the steady east wind made his crews uneasy. On his first voyage when 16 days out from the Canaries he experienced a westerly wind and wrote,⁴ "This contrary wind was very necessary for me because my people were much excited because they thought no wind blew in these seas to return to Spain." Columbus had voyaged from 60° N to 10° N and must have known the trades and west winds. When returning he went north from the West Indies to about 35° as was correct.

THE VOYAGE OF CABRAL; DIAS SHOWS HIM ALSO HOW TO GO.

Dias induced Cabral to follow the correct course, showing his estimate was not a guess. In 1500 the King ordered a fleet of 13 *naos navios* and *caraveles* Barros says,⁵ adding Pedralvarez Cabral was *capitao mor* of this and Bartholomeu Dias, "Who discovered the Cape of Good Hope" commanded a ship. Barros continues, "The number with the fleet seamen and soldiers was 1200 persons, all chosen of good repute well-armed and properly prepared for the voyage x x. The 9th of March x x the fleet sailed steering for the Cape Verde Islands to water where they arrived in 13 days. But before reaching this being among these islands

⁴ Journ First Voy Hakl entry Sept 22.

⁵ Asia, 1, 5, 1-2: *Naos* and *navios* are large ships and ships; *capitao mor* means chief captain.

they were in a storm in which one ship lost company. The dispersed fleet drew together when the storm passed. To avoid the coast of Guinea where the calms would prevent them from making good speed they engulfed themselves in the sea so that they might be sure to double the Cape of Good Hope. A month after they had taken this course x x the 24th of April they saw a coast which by the estimation of the pilots was to the west of the coast of Guinea 450 leagues; and the altitude of the antarctic pole on the side of the south was 10° . The pilots said it was a great island found by Christovao Colom who was of Spain and the Spaniards commonly called it Antilhas.⁶ They ran south along the coast for on this course the wind was fair till they reached a port of very good security x x. This Pedralvarez called Porto Seguro; x x he sent a vessel home to King Manuel with the news. x x The 3d of May Pedralvarez wishes to sail and ordered a great cross set up x x giving to the land the name Sancta Cruz. x x Sailing from Porto Seguro for the great crossing between that land of Sancta Cruz to the Cape of Good Hope there appeared the 12th of May a great comet with a ray which remained always toward the Cape of Good Hope. It was seen by all in the armada for 8 days without moving from that place.⁷ It seemed to prognosticate danger. When it disappeared the following day which was 23d of May there was a great sea.⁸ We prepared the ships against a great black cloud to the north. x x It burst so instantly as not to give time to reduce sail and 4 ships foundered. Their captains were Aires Gomez da Silva, Simao de Pina, Vasco de Taide, and Bartholomeu Dias. He after passing through so many dangers at sea and making so many discoveries principally the Cape of Good Hope this furious wind ended his life with that of others burying them in that great abyss the Ocean Sea."

⁶ They had re-discovered Brazil, for it had been found at least once before; below p 556. It is commonly said Cabral was blown thither but the fact is far otherwise. Latitude 10° S is that of the coast of S America 1800 miles S S W of the Cape Verdes; they had run this in a month, a speed of 60 miles per day. The pilots made large error in saying this was 450 leagues west of Guinea; it is west from Africa in the same latitude 2880 miles, 960 or 720 leagues as we take the league at 3 or 4 miles.

⁷ This must have been the Southern Cross: but it was not toward the Cape of Good Hope. In Magellan's voyage too it is reported ahead, that is west; "We discovered to the west 5 very brilliant stars placed exactly in the form of a cross;" the ship was well away from the Strait steering W N W across the South Pacific; Premier Voy Fr trans Amoretti's Pigafetta p 55.

⁸ They were 20 days out: the distance to a point off the Cape from where they had come on the coast of S America is 3000 miles; an average day's-run of 150 miles, which the ships may have made in the strong west winds in these latitudes. In Barros' narrative however it is not stated the ships were near the Cape.

THE DIVISION OF THE EARTH BETWEEN PORTUGAL AND SPAIN.

Believing correctly his ships had been within the demarkation of the Spanish crown, when the ship Cabral sent home reached him King Manuel wrote the Spanish King. His letter⁹ describes the voyage in a general way calling it, "By the coast Africa to the Red Sea," thus showing that whoever wrote it was not a pilot. Maitre Joao pilot-general of the fleet Cabral and others landed at Porto Seguro to determine latitude; no doubt by large astrolabes suspended on tripods. They made it 17° S which is about right.¹ In his letter King Manuel wrote, "My captain left Lisbon March 9 last year x x and arrived at a land newly discovered which he called Sancta Cruz x x which is very convenient and necessary for the negotiation to India. He x x sent me a vessel to say he had found it and continued his voyage to the Cape of Good Hope. In these waters before arriving there he experienced heavy gales² and in a single day before his eyes foundered 4 ships from which no-one was saved." Cabral had been within the half of the earth given to Spain by Pope Alexander VI whose bull dated May 4, 1493 followed the return of Columbus from the West Indies. The Pope granted to Spain,³ "Out of Our mere liberality and of certain science and plentitude of Apostolic Power all islands and continents found or which may be found and discovered towards the west and south from a line from the arctic pole x x, which line is distant from each one of the islands commonly called Azores and Cape Verdes 100 leagues towards the west and south x x." This was modified Sept 25, 1493 by an Extension de la Concesion y Donacion Apostolica de las Indias.⁴

SHIPS SEARCH FOR A ROUTE TO THE EAST BY THE WEST.

We have come to pregnant days; there are accounts of handling ships and position finding such as were not written before and of extraordinary mistakes such as in the letter of King Manuel and the Papal Bull, and when a voyager returns and tells his story others set out to follow and pass beyond into oceans no ship of Europe had entered. In consequence of Cabral's discovery a squadron sailed May 13, 1501 from Lisbon to make further exploration. Its commander is unknown but Americus

⁹ Pp 94-101 v 3 Navar Colec.

¹ Bensaude Astr Nautique au Port p 103.

² *Grandes tormentas*; this is p 95 v 3 Navar Colec.

³ Navar Colec v 2 p 28; pp 600 and foll'g below.

⁴ Navar Colec v 2 pp 404, 33.

Vespucius was in one of the ships. They followed the coast of South America to 25° S and then struck off seaward S E 1500 miles to 52° S, where if far enough west they would have seen the head-land now called Cape Virgin, the east entrance to the great Strait. They were in waters unknown in Europe. April 2 they discovered an island and some think they looked into the Strait. Then they returned and another fleet left Lisbon June 1503 to explore the same waters under command of Gonzalo Coelho with Vespucius in it. Coelho's orders were to find a way to the Spice Islands—the Moluccas—going west, around or through *Mundus Novus*, the New World, what we call South America.⁵ Why the Portuguese wished to discover a second way to the East is not clear for they were by the Partition of the Pope in possession of the route around the Cape of Good Hope: further, while Cabral entered Spain's half of the earth when Brazil was found, the Portuguese ships sent to follow were in Spanish waters, as Portuguese cosmographers and pilots must have known.

Cabral did not touch at the Cape of Good Hope but passed on for Mozambique and Sofala. Co-temporaries of Dias understood his great discoveries better than we do now. Barros makes recognition when telling his death, and Galvano a Portuguese official and author born in Lisbon 1503 who went to India in 1527 wrote, "In the year 1486 the King Don John sent on discovery Bartholomeu Dias a gentleman of the court with 3 sail: coasting along he placed pillars of stone and discovered the Cape of Good Hope and beyond as far as the Rio Infante and it may be said he saw the land of India but like Moses and the promised land did not enter in."⁶

COLUMBUS.

Very little left by Columbus and those with him but has been commented on. As has been said this is to be expected in regard to one whose name stands for the greatest event in history, that by which the size of the world was doubled. The seafaring part of Columbus' history in which alone we are interested has however received less notice and controverted points will be avoided as much as possible. He aimed to discover the East by going west; very old so far as imagining goes but serious and novel in accomplishment.⁷ Columbus' purpose that

⁵ Below n 8 p 574; Ravenstein Behaim and His Globe p 37; Fiske Disc America v 2 p 167.

⁶ Discoveries of World Galvano Hakl p 77.

⁷ Strabo wrote 1500 years before ships setting out to circum-navigate going west and east had not yet met; above pp 226-30.

at least of those who aided him with money and otherwise was commercial. The produce of the East came up the Red Sea and through Alexandria or by caravan and across the Caspian and Black Seas and many levied tolls on it. Columbus would change this by going to the place where the products originated; but he would go there by the West and his fleet was the first that attempted this. No doubt he had hopes to discover new lands; but this was uncertain and of doubtful value while to bring from the East a cargo that could be disposed of at enormous profit was very real.

He had to know how far it was across the sea to the Indies; the peninsula of Malacca or east side of the peninsula of India; and his conclusion should have been about the same as would be reached in our day if we ignored America lying in the way. He should have known, probably did know, the measures of geographers of the circumference of the earth and distance *east* from Europe to the outer coast of Asia; the distance *west* was, as every school-boy knew, the difference of the two. For the number of days it would take his ships to go so far he must carry water and food, a point it is impossible he overlooked for that would be going forth to die. Arab seamen determined the distance from Europe to the east of Asia at 7500 miles 700 years before his day and the circumference of the globe had been determined several times in years from 300 B C on at 20000 miles;⁸ so Columbus had 12500 miles to go. He believed he had 2000 to 2500.

Below is given much to indicate how he may have reached this belief, and here is stated all that is known regarding providing the ships employed. In 3 documents given by Navarrete^a we read,—In the first, “Requisition Upon the Inhabitants of Palos for 2 of the Vessels Composing the Fleet: Don Ferdinand and Dona Isabella by the Grace etc; You are well aware that in consequence of offence We received at your hands you were condemned by Our Council to render Us service of 2 caravels provided [the word is *armada*] at your expence for the space of 12 months. xx Inasmuch as We have ordered Christopher Columbus to proceed with a fleet of 3 caravels as Our captain to certain parts of the ocean xx We desire that the 2 caravels xx shall be placed at his disposal.

⁸ Above p 235 as to measurement of distance to east coast of Asia; p 226 as to earliest measurements of size of the earth and 238 as to measurement by the Arabs about 825.

^a Nos 7, 8, 9, pp 11–16 v 2 Colec: they are all 3 orders of the King and Queen dated April 30, 1492.

xx We hereby order you have in complete readiness the said 2 provided caravels xx, and for the crews of the 2 caravels We order him to pay you forthwith 4 months wages xx at the common allowance for ships-of-war." In the second, the coast towns, being informed Columbus is to sail with 3 *carabeles armadas*, are ordered to furnish all he may need and call for, "Wood, carpenters or other mechanics, rigging for ships, necessary supplies of bread wine meats fish gunpowder, furnishings and other stores, and all other things to prepare renovate repair or victual the said carabeles xx," and that all needful shall be provided, "At reasonable price." In the third the King and Queen promise pardon and amnesty to all who go in the caravels for crime committed before and during the voyage and for 2 months after returning.

The 3 orders were issued it will be noted shortly before Columbus sailed. They were signed at Granada, very lately captured from the Mahometans, "Yo el Rey, Yo la Reina." It should also be noted that Columbus purchased all supplies, but not the ships, and that the amnesty granted shows how difficult it was to man the ships; but the point we most desire to learn about—how much food and water was carried, is not made clear.

There are 2 notes written by Columbus in the margin of the *Imago Mundi* a work of about 1410. The first reads, "Know that often in sailing southward from Lisbon to Guinea I carefully reckoned the course and run according to the custom of pilots and mariners and took the sun's altitude with a quadrant or other instrument and always found my calculations agreed with those of Alfragan; that is a degree was equal to $56\frac{2}{3}$ miles. So we may rely upon this measure."⁹ The second passage reads, "Aristotle says that this world is small and that there is very little water and that easily a ship may go from Spain to the Indies. This is confirmed by Averroes and by Cardinal d'Ailly x x. Upon this we have also the authority of the 3rd book of Esdras where we are told that of seven parts of the world six are uncovered and one covered with water."¹

If these passages were written before his 1st sailing Columbus must have been trying to determine how far he had to go to reach India; if written after that time he was discussing a thing familiar to cosmog-

⁹ Fiske *Disc America* v 1 p 377 note; Vignaud *Hist Crit Colomb* v 1 p 63 note.

¹ Fiske v 1 p 380 note; Vignaud v 1 p 317; Navarrete v 1 p 261: in the last the words are part of a letter Columbus wrote the King of Spain about 1498.

raphers. As a seaman and cosmographer he must have known that if one travels on the earth's surface one degree of its circumference and measures the distance travelled the circumference is 360 times the last. The change of one degree would be measured by raising or lowering the pole-star one degree and the distance by a chain or tape-line. This had been done about 300 B C and again 700 years before Columbus' day by order of the Caliph of Baghdad. The last measurement was over the land and Columbus' determination agrees exactly with it: a degree on the earth's surface is $56\frac{2}{3}$ miles and as $56\frac{2}{3}$ multiplied by 360 is 20400 this is the circumference of the earth. In the writing it is said he made the measurements onboard a ship at sea; that is he noted the course and distance sailed while the altitude of a heavenly body changed one or more degrees; taking care to allow for the motion of this body itself. Details had to be attended to: the simplest way would be to steer north or south while the pole-star rose or fell a measured amount; but even here corrections would be necessary for the pole-star moves. Columbus knew this and must also have known a length measured by a ship in this way was of low order of accuracy. The angles he measured were also of low accuracy as he must have known, or should have known, for others of his day knew it: a pilot who was with Cabral in his voyage to India in 1500—he may have been personally known to Columbus—said observations by stars could not be relied on closer than to 4° to 5° .² The pilot did not estimate the error when using the sun by day but could hardly have believed it lower than 1° , and if we put it as low as $\frac{1}{4}^{\circ}$ and suppose Columbus contrived to use the sun in measuring change of angle his determination would be out by $\frac{1}{4}$. This supposes the course and distance of the ship were correctly taken. That Columbus should have made the observations recorded cannot be reconciled with the supposition he was a pilot and cosmographer; further, it cannot but be regarded with suspicion that the result is correct. It would seem the story is a tissue of falsities, he never made the observations for the purpose stated and the writing in the *Imago Mundi* is not his.

In the statement above Columbus says nothing of the distance to the Indies east from Europe which is to be subtracted from the circumference of the earth to find the distance his ships must go west. I do not know where to look for what he says Aristotle wrote of the size of the earth and the ease with which ships might go from Spain to the

² Above p 331.

Indies; west of course. Averroes whom he mentions was an Arabian cosmographer of 800 A D, the golden age of the seafaring and cosmography of his people, in whose day not only was the size of the earth re-determined but measurements made east to India from Europe: Ibn-Khurdadbeh made it 7500 miles from the head of the Red Sea to the East about 870 A D and Masoudi 50 years later made it 7500 miles from the Fortunate Islands the islands west of the north end of Africa to the east of China. With these measurements another Arab geographer, Aboulfeda writing 400 years later but before Columbus' day, states agreement. If Columbus did not know these measurements his knowledge was very poor. The most extraordinary part of the passage is that regarding the Book of Esdras an apocryphal part of the Bible not found in our editions but in Septuagint Bibles. This is as follows being contained in a description of the Creation of the World,³ "Thou didst command that the waters should be gathered in the seventh part of the earth; six parts hadst Thou dried up and kept."

Only upon these words can Columbus' conclusion be rested. Many had found the round of the earth about 20000 miles and accepting the Book of Esdras he had to go $\frac{1}{7}$ of this, 2800 miles, west from Spain to reach Manzi and Cathay: it is extraordinary the distance from Gomera in the Canary Islands to the nearest part of the West Indies, which was Columbus' first long run, is 2600 miles. Until death he believed the lands he had discovered, now called West Indies, were the Old Indies; found for Europe by Megasthenes a follower of Alexander the Great about 320 B C; for in a letter dated July 7, 1503 written when his ship was exploring the Isthmus of Darien he says,⁴ "From here it is 10 days' sail to the Ganges River." He was 10000 miles, 100 days' sail, from the mouth of the Ganges. We must not however be unduly critical for discovering and mapping the earth was a heavy task. We should not be surprised at the authorities on whom Columbus rests his case for every-one did so in the day. It is strange he failed to examine and cite

³ Vignaud Toscanelli and Columbus p 86; see also pp 560-1.

⁴ P 299 v 1 Navar Colec: the letter begins p 296 and is inscribed, "Written by Don Cristobal Colon Virey y Almirante de las Indias to the Most Christian and Most Powerful King and Queen of Spain Our Lords in which they are informed of all that has happened in this voyage and the lands provinces cities rivers and other marvellous things in which are mines of gold in great quantity and other things of great richness and value." Shortly after Columbus returned to Spain and died at Valladolid in 1506 in great misery and disappointment: an Eng trans of the letter is pp 175-211 Select Letters Columbus Hakl.

the conclusions of Ptolemy the Geographer; he would have been put right if he had, but then perhaps in view of the long distance he would have been shown he must go he would not have sailed or his patrons would not have enabled him to fit the ships. It was expected land would be made about 2000 miles west from the Canaries but whether because of the Book of Esdras or because a pilot whose ship is said to have been driven by gales west to the Indies had told Columbus how far away land was is not known.⁵

THE STORY OF THE PILOT.

The pilot must have believed his ship was blown to China for no-one knew of America, though there were tales in all ages of islands in the Atlantic. The story consists in a tale that a friend of Columbus and famous pilot was blown across the Atlantic, saw land there, returned, and lying sick revealed this to Columbus and died.⁶ Some say it was Juan de la Cosa; but he was captain of the ship in which Columbus crossed and after returning made a map now in Madrid.⁷ Though Vignaud does not state all details of this story he appears to accept it as true and gives it examination from contemporary authorities. From his conclusion I am disposed to dissent because it is impossible for a ship to be blown away 2500 miles where the pilot is supposed to have been; that is steady wind so strong and seas so great for 25 to 30 days as to force a ship to run are not found. The question is of interest for Columbus cannot have measured the water and food he took from nothing at all nor from what is in the Book of Esdras; so being at a loss to resolve the question I insert the words of a co-temporary author.

WHAT OVIEDO A CO-TEMPORARY OF COLUMBUS WROTE OF THE STORY OF THE PILOT AND OF COLUMBUS.

Oviedo a Spaniard who was 14 years of age when Columbus sailed on his first voyage wrote a *Historia de las Indias*. He was long resident in the West Indies having made more than one voyage thither and knew

⁵ Young Columbus p 294 v 2 says Columbus gave the ships a rendezvous in case of separation 2100 miles west of the Canaries, but I do not know where the original statement is found. There is little doubt he hoped to find land before going as much as 2500 miles; see Fiske Disc America v 1 p 377. Fiske rests this on a map made by Toscanelli a Florentine, which map Fiske says Columbus took in his ship (the map is shown by Fiske); but this is denied by Vignaud at p 179 his Toscanelli and Columbus. Vignaud's analysis is very convincing but leaves us without conclusion.

⁶ Vignaud Toscanelli and Columbus pp 110, 113 note, 132.

⁷ See p 13 v 2 Fiske Disc Amer; at frontispiece Fiske shows the map.

and conversed with associates of Columbus and probably with the great Navigator himself. It is manifest from his book he was not a seaman and therefore what he says he derived from others. As regards the Story of the Pilot he had heard the talk in the West Indies regarding it; and after describing Columbus' personal appearance and saying he was born near Genoa—he writes the name Chripstobal Colom—he continues,⁸ “Having reached man's estate he left his own country and went to the Levant and voyaging much in the greater part of the Mediterranean learned and practiced navigation. After voyages in these parts as wishing for larger seas and higher thought, wishing to see the most great Ocean he went to Portugal. Some say a caravel from Spain for England x x was so overcome by rough and foul weather and ran to the west so many days that she saw (*reconoscio* is the word) one or more of the islands of these parts of the Indies x x. The greater part of her cargo was food and eatables and wine which was found enough to sustain life in so long a voyage. x x She had favorable weather in returning to Europe. So great was the suffering and deprivation however x x all died but the pilot and 3 or 4 others x x and they died as well. With regard to this it is said this pilot was a great friend of Chripstobal Colom and that he knew somewhat of latitudes (*alturas*) and marked the land he found and with much secrecy informed Colom of this begging him to make a chart and put on it the land he had seen. It is said he received him at his house as a friend and nursed him for he became very sick. But soon he died as the others did and this Colom remained informed of the land and navigation of these parts, himself only knowing the secret. Some say this master or pilot was of Andalusia others Portuguese x x. Whether this is true or no no-one can say; the story as received by most is given. For me I hold it untrue; as says Augustino it is better to doubt the things we do not know than put our trust in things undetermined.”

Oviedo gives his views as to navigating in general and I quote this although disbelieving not a little of it;⁹ “It is the opinion of many and reason teaches them to believe it that Chripstobal Colom was the first in Spain who learned to navigate the immense Ocean by degrees of latitude of the sun and the north (*alturas de los grados de sol y norte*). He applied it as well for until then though it was taught in the schools few

⁸ Pp 12-13 (bk 2 ch 2) v 1 Hist Gen y Natural de las Indias Oviedo re-print Madrid 1851-55 3 parts in 4 vs.

⁹ Pp 18-19 v cited.

not to say none dared try it at sea. Seamen pilots and men of the sea until then arbitrarily did their work according to the judgment of the master or pilot; not accurately and with the science that is today used in these seas, but as in the Mediterranean the coasts of Spain Flanders all Europe Africa and the rest of the world where no-one departs much from the land. But to navigate places as distant as these Indies from Spain pilots must use the science of the quadrant for the seas require both latitude and longitude as from here to Europe or the *Especiera* we steer to the west of the *tierra firme* of these Indies.¹ Thus moved Colom as a man who had learned the secret of this kind of navigation so far as finding the way, as learned in this science, and being assured by the pilot who as already stated gave notice of this hidden land in Portugal and of the islands, if so it was x x, tried by his brother Bartolomé Colom with Henry VII x x to fit vessels to discover." Upon failing with Henry VII in England attempts to procure funds and ships were made in Portugal and Spain, the last being successful. Oviedo says Columbus had 3 caravales; Gallega Pinta and Nina by name, and, "In all about 120 men:" but neither he nor any one else says a word to indicate for how many days provision was carried.

The Story of the Pilot while perhaps generally discredited has been widely circulated. It has the same relation to Columbus' great undertaking as a map said to have been made by Toscanelli which some authorities believe was in Columbus' ship.^a This has been re-drawn in late years, for the original map has never come to light. If it was in Columbus' ship or if he had seen and believed it, for it is as much in error as Columbus' views seem to have been, or if the Story of the Pilot is true, we understand everything. We believe Columbus *expected* to make land—an island or continent—2000–2500 miles west of the Canaries and carried food and water for 40 to 50 days, though hoping to make the passage in about 25. Toscanelli was a noted cosmographer and his map—if he made one like those recently drawn—is more difficult to explain than the views of Columbus. Neither the Story of the Pilot nor Map of Toscanelli should be accepted unless reasonably probable in order to round-out a theory. If we accept his map we must conclude

¹ It looks as if he were in the West Indies. By *Especiera* he means Spice Islands; far west of the *tierra firme* of Darien whence ships were voyaging in the Pacific.

^a P 560 below; a reproduction is p 356 v 1 Fiske's *Disc America*.

Toscanelli was a poor cosmographer and put Columbus in the same class if he followed it. In regard to the Pilot 2 contemporary authors beside Oviedo express doubt similar to his; Las Casas and Fernando the son of the Admiral.^b Both these mention the Map of Toscanelli and the letters said to have passed between the Florentine astronomer and Columbus and both describe the Map but neither says the Admiral had it with him. From these descriptions the Map has in our day been drawn.

Oviedo's work has a chapter called Of the Voyage Made from Spain to These Indies and the Manner and Form in This Navigation. Here is written,² "Ships (*naos*) are 8 to 10 days from Spain to the Canaries making 250 leagues I mean to Hierro; x x it is 25 days from here to the islands Guadalupe Dominica etc and 750 leagues—some charts show a little more, others a little less. So from Spain here is 1150 or 1200 leagues more or less. This is by the most correct charts which are better than the older ones x x. Each day the route is better understood and the most maintain the voyage is 1200 leagues more or less.³ Because of the north-easting and north-westing of the needless and changes of weather and currents many more leagues are sailed than just given; generally in coming out and more still in returning to Spain, for the route from here to Europe is quite other than I tell x x. In returning from here to Castile is required about 55 days, though in the year 1525 2 caravels went from the city of Sancto Domingo to the mouth of the River of Seville in 25 days x x. Sometimes vessels are 3 or 4 months in returning to Spain because of trying to follow the route by which they came out; but this is now better understood and as pilots grow more skilful the ships return by the north, looking for the Island of Bermuda also called *Garca*, which is in 33°, which sometimes they see

^b See respectively Hist de las Indias Bibl Mexicana 2 vs Mexico 1877 v 1 p 141; and Hist de Fernando xx de Su Padre p 7. The former recounts, "It was common among those who then lived in Hispaniola xx to say the Admiral was moved to discover the Indies in this way;" then the Story of the Pilot is told and Las Casas concludes, "But in truth xx to me it appears xx we discover what we discover and find what we find as though within a chamber with its key we should find it." Fernando tells of a pilot coming from Guinea who, "Saw or believed he saw a Tierra," who upon reaching home fitted a ship and, "Searched for this land all his life but did not find it."

² Pp 35-40.

³ The distance from San Lucar de Barrameda at the mouth of the Guadalquivir below Seville to Ferro in the Canaries is 800 miles and from Ferro to Domenica 2200. The sum is 3000 miles, which Oviedo says ships usually run in 33 days: this is 90 miles per day made good; 110 to 120 sailed.

and sometimes do not⁴ When ships are in this latitude (*altura*) they leave the route to the north until then held to and run to the east the way to the Orient for Acamore⁵ in Africa, and from Acamore to San Lucar where the Guadalquivir enters the sea it is 80 leagues. This manner of voyaging shows experience, for after reaching 33° the winds are north-west and north. I have seen the island of Bermuda at a lombard shot from it x x running in 8 fathoms of water."

We know these things now but should note that from total ignorance Spanish seamen in 25 years found and followed the sailing-routes now followed in the North Atlantic. Oviedo also says,⁶ "Some days before Colom went to sea he had long consultations with a religious by name Friar Juan Perez of the Order of St Francis his confessor. This Friar was the only person in this life to whom Colom communicated his secrets; from him and his science it is said until today that he had much help and assistance for this religious was a great cosmographer." Oviedo was born at Madrid 1478 and died at Valladolid 1557. His book was first published in 1535 and he often uses the name *Nuevo Mundo* to mean the Indies discovered by Columbus; the latter, who died 1506 15 years after he reached the West Indies, until his death believed he had found Asia.

SOME TECHNICAL THINGS REVEALED BY COLUMBUS.

When Columbus sailed he says, "*Tomo la vuelta*,"⁷ of which our phrase for the same thing, *took the departure*, is the translation; it means to take a compass-bearing of an object on the land left, estimate how far from this the ship is and use the compass-bearing reversed as the first course entered in the log. Oviedo says ships began at once going the correct route out and home and that 2 caravels in 1525 ran from San Domingo to the River of Seville in 25 days: the distance is 4000 miles so the distance made good per day was 160 miles; it was as good as a Liver-

⁴ The town of Hamilton in Bermuda is 32° 15' N. It gives an idea of the activity of Spanish seamen to note that Bermuda was found by Juan Bermudas in 1522, 30 years after Columbus reached the West Indies. It is said to have been uninhabited until 1609 and its latitude in early days must have been determined on ship-board not after landing.

⁵ The name of an ancient kingdom and city in 33° 30' on the coast of Africa, very nearly due east from Bermuda.

⁶ P 21.

⁷ Journal Sept 6.

pool Black-Baller or California Clipper of the '50s. Columbus' routes out and back are as they would be made today.⁸

Columbus gives the latitude of the north side of Cuba at 42° , nearly double its true value, 3 times in his Journal.⁹ These errors are in the Journal but in another place he contradicts himself saying of Cuba,¹ "The country is only 26° from the equinoctial line." The northernmost part of Cuba is a little more than 23° and we must conclude that 42° for a latitude only 21° involves some error not attributable to Columbus or his pilots.

Here are words of Columbus about an observation of the pole-star with a quadrant, "I devoted many nights to a careful examination with the quadrant and I always found that the lead and line fell to the same point."² Quadrants were a quarter-circle with peep-sights on one straight edge. Looking through the peeps at a star or the sun, the plane of the instrument being vertical, a cord with a weight showed on the scale on the circular edge the height of the star or sun. The quadrant like the astrolabe swung at sea and was inaccurate: both were inconvenient because their face on which the scale was marked could not be seen by the observer when he held the instrument to his eye; therefore when the peeps were on the object and the instrument vertical and stationary the observer caught the cord of the quadrant fast on the scale or the turning diameter of the astrolabe in the same manner, and read the angle at his leisure. At times a second person stood near and noted the angle when the observer cried *mark*. Quadrants with line and lead were used by Columbus and others: when returning on his first voyage being about 38° N the Journal reads,⁴ "The Admiral was unable to take the altitude with either astrolabe or quadrant because the rolling prevented it. The course was E N E going

⁸ Navar Colec v 1 pp 352 for maps showing routes crossing and 454 for those in the W I: also Winsor's Columbus p 196 and map at end Tavola di Bronzo Banchero.

⁹ Navar Colec v 1 pp 44, 62. Navarrete adds in a note, "Quadrants of these days gave the double altitude:" instruments were common in which a ray of light fell on a concave circular surface and was reflected to the opposite side of the circle on which degrees were marked, and thus a double angle was shown, unless as was usually done the degree-marks took care of this; Navarrete's explanation does not explain for Columbus should have known this: see also above pp 333-4.

¹ Navar v cited p 172; Sel Letters Columbus Hakl p 13. The erroneous statement of Columbus about latitude most difficult to explain is for Dec 13 in his Journal where he gives a latitude really 20° at 34° ; see below pp 552-3.

² Navar Colec v 1 p 155; Sel Lett p 134 note.

⁴ This was a mid-winter passage: as showing how little this was noticed the circumstance is not alluded to.

10 miles an hour so that in 11 hours he made 27 leagues.”⁵ The ships could run: the next day the entry is, “During the night the course was N E by E going 12 miles an hour part of the time and the rest 10. Thus they made 130 miles or $32\frac{1}{2}$ leagues.”⁶

There is nothing in the Journal about how speed was determined. *Ampolletas* sand-glasses are mentioned and from the context it is manifest they were half-hour glasses,⁷ used probably to determine the hour of the day: shorter glasses would be used to measure speed. The Journal reads Nov 2, just following statement the latitude was 42° when correctly 21° , “The Admiral by his reckoning (*por su cuenta* ⁸ in Navarrete) finds he has gone over 1142 leagues from the Island of Hierro.” The correct distance was 1105 leagues; an error of 37 leagues in 1105, $3\frac{1}{3}$ per cent.⁹ This could have been measured only by courses taken from compasses and distances from estimates made by looking at objects in the water floating sternward: the Spanish now call dead-reckoning both *estima* and *derrota estimada*.¹ There is an interesting entry in the Journal for Sept 19: there were reasons for supposing land was near and, “The Admiral did not wish to cause delay by beating to windward to ascertain whether it was near. x x The pilots found their positions, he of the Nina made the Canaries 440 leagues distant the Pinta 420 and the pilot of the Admiral’s ship made it just 400.”

We do not know exactly how speed was measured but careful reckoning was kept. The latitudes by observation have been examined but there remains a fact regarding these to be noted: no latitude stated in the Journal of the First Voyage, the only Journal or Log we have from Columbus, was measured onboard a ship at sea; yet he observed at sea, for we read of his using a quadrant at sea in taking the pole-star and on another occasion he says the ship was rolling too much to use either astrolabe or quadrant.² Presumably in good weather he observed at sea. He wished to keep his navigation secret; but this was impossible for he had

⁵ Journ, entry Feb 3. He says 11 hours at 10 miles per hour or 121 miles is 27 leagues; this makes the league $4\frac{1}{2}$ miles: we shall find it differently stated.

⁶ The league is 4 miles.

⁷ Modern Spanish dictionaries give *ampolleta* a half-hour sand-glass; *reloj de arena* sand-glass hour-glass.

⁸ We must suppose these are the words in the original. They mean dead-reckoning.

⁹ This true distance is copied from p 66 Journal Columbus Hakl, being a note by the editor Markham.

¹ Pp 323, 345-47, 351, above.

² Above p 550.

capable pilots with him, the most renowned being Juan de la Cosa whose map has been mentioned. Dead-reckoning was kept and latitude found by observation; there was no way to determine longitude except by dead-reckoning and with this if a ship is long in a current the accumulated error may be great.³ Columbus recorded attempts to determine longitude by observation: when near Jamaica in August 1494 he thus determined the longitude to be $51\frac{1}{2}$ hours west from Seville, an error of about $11\frac{1}{2}$ hours, and in February 1504 he predicted an eclipse, frightening natives into bringing him food he needed.⁴ He probably carried tables giving positions of the heavenly bodies for a year or more in advance but not until 250 years after was the motion of these sufficiently understood to calculate positions with the accuracy necessary to find longitude.⁵ The approximate hour of eclipses had been calculated 2000 years before, for this requires less close knowledge of position, and Columbus' failure to determine longitude accurately was due to errors in the tables he had with him.

The Admiral states a latitude determined by 2 observations of different character. In the Journal for Dec 13 is written, "The Admiral measured by experiment the number of hours in the day and night and from sunrise to sunset: he found that 20 *ampolletas* ⁶ which are of half-hour passed but says that here may be mistake because they may not have been turned quickly or some sand left unpassed. He also found by the quadrant he was 34° from the equinoctial line." He was a scant 20° from it as the Journal shows. On December 13 in 34° N the time from sunrise to sunset is 9 hours 46 minutes. Since he believed the ship in 34° the error in measuring the length of the day was 14 min; but as she was actually on the north shore of San Domingo at its western end the latitude was a little less than 20° . The time between sunrise and sunset on the same day in this latitude is 10 hrs 48 min: the error in using the sand-glasses was 48 min. The record of Dec 13 and preceding days indicate the ship was in harbor when these observations were made and it is impossible Columbus should err so much as to make 20° , 34° . If at sea and the sea

³ A ship steering west from the Canaries for the West Indies and making land in 25 days if the velocity of the equatorial current is on the average $\frac{1}{2}$ knot per hour as it might be would be 5° west of her dead-reckoning, 300 miles.

⁴ Columbus Winsor pp 301, 465.

⁵ Pp 649 and foll'g below.

⁶ The words and from sunrise to sunset are in Navarrete, *y de sol à sol*; and *ampolletas* which are of half-hour are *ampolletas que son de à media hora*.

were rough he might possibly do this; but this explanation is unsatisfactory because record was kept of courses and distances, and position by dead-reckoning frequently worked out, and so great an error would be impossible in this. It is too great to be attributed to those who used the quadrant and must be ascribed to a copyist of the manuscript; the Deck Log as we call the rough log made on a ship's deck.⁷ The error here and others noticed⁸ were made in copying the manuscript, for they could not have been made by anyone whose claim to be a pilot was of the smallest.

It is interesting to enquire how in observations made in port in these days the instrument—quadrant or astrolabe—was used. Modern instruments look at the horizon and the body whose altitude is to be ascertained, and because the observer is above the water, a correction called *dip of the horizon* depending on how high the observer is is applied. When observing in harbor or with a horizon other than the sea-horizon, that is with the edge of the water on a coast-line correction for dip other than the one referred to and depending on how near the said coast-line is is used. But the use of the last horizon is resorted to only when unavoidable; when near enough the observer lands with measuring instrument and *artificial horizon*—a little cup protected from the wind and containing mercury molasses or water. He views the image of the body whose altitude he wants reflected from the liquid of the artificial horizon and measures the angle between reflected image and the body seen directly; this is double the altitude. Artificial horizons are useless onboard a ship as she is never still enough. Ages before Columbus lived artificial horizons were used.⁹ Pilots of Columbus' day did not need artificial horizons and they are not indicated in any writing or ship's inventory, for astrolabes and quadrants were independent of the horizon: hung on the observer's finger or from a frame when onshore, they stood vertical and were used at sea in harbor or after landing in the same manner. As they swung at sea they were poor instruments; the cross-staff and back-staff which were held on the horizon were much better.¹

⁷ In the Journal for Dec 5 there is another determination of the length of the day; but less informing than the one of Dec 13: for comment on that of Dec 5 see pp 163-4 v 2 *Rel des Quatre Voy Columb Navar* 1828 3 vs.

⁸ P 550 above: below 559 for Columbus' statement he falsified the record and why.

⁹ P 226 n 7 above.

¹ Above p 343.

COLUMBUS' VIEWS ON NAVIGATION: HE NOTICES THE VARIATION OF
THE COMPASS.

Like men in his day Columbus saw visions and dreamed dreams: he says in a letter regarding his 4th voyage,² "There is the reckoning and the principles of astrology (we would say astronomy meaning what Columbus meant by astrology); they are certain. To those who understand these suffice. This resembles a prophetic vision." When 7 days out from Gomera on his first voyage he wrote Sept 13, "On this night the needles turned to the north-west and in the morning they turned more north-west;" and Sept 17, "The pilots marked the north and found the needles had turned to the north-west a full point. The mariners were alarmed and anxious but did not say why. The Admiral knew and ordered them to return to mark the north again in the morning and then the needles were found true. The cause is that the star appears to make the movement and not the needles." This reads as though the card was turned on the needle and then pinned fast again so that the crew might not be uneasy: Columbus turned a compass card once before for similar purpose.³

This is the first mention in Europe of the variation of the compass a phenomenon known earlier in China.⁴ The words *marked the north* in what is recorded above from Columbus may mean the north was marked by the pole-star; but there was a better way, for the star and compass as means of marking the north were both under suspicion: this was by an astrolabe or quadrant,⁵ and there is proof seamen used this way of determining direction. Pigafetta wrote of Magellan's voyage 25 years after that of Columbus and says, "By means of an astrolabe composed of plaques the meridian line may easily be taken x x by day by the sun by night by the stars or moon."⁶ Columbus refers twice more to compass-variation: in about 1500 he wrote, "When I sailed from Spain to the Indies I found as soon as I passed 100 leagues west of the Azores a most great change in the heavens and the stars x x. The needles which until then turned north-east turned north-west a full point and this was as we

² Navar Colec v 1 p 306; Select Letters Hakl p 197: his words are in the former, *Una cuenta hay y razon de astrologia y cierta; quien la entiende esto le abasta. A vision profetica se asemeja esto.*

³ Above p 271.

⁴ Above p 265.

⁵ Above p 239.

⁶ Prem Voy trans Amoretti p 283.

reached that line:" the second mention reads, "I return to the reasons written above as to the line that passes from north to south 100 leagues west of the Azores, that in going from there to the west x x the compass-needles change because of the mildness of the air one point and the further we went the more it advanced to the north-west, and this altitude causes the circle described by the north-star and its pointers to vary."⁷ Some have taken the view that many believed the needle follows the pole-star around the pole and thought when a needle was carried south until the pole-star sank below the horizon its directive force was lost and the compass became useless.⁸

THE CABOTS; FATHER AND SON.

The variation of the needle was soon suggested as means of finding longitude. In a letter of December 31 1522 the Venetian ambassador in Spain wrote the Senate, "Sebastian Cabot discussed many geographical points with me and told me of a method he had observed of finding the distance between 2 places east and west of each other by means of the needle. It is a beautiful discovery never observed by anyone else as he will be able to explain when he comes before Your Serenity."⁹ We also read of Sebastian Cabot in the volume cited, "He was so learned and experienced in matters relating to navigation and cosmography that he has not now his equal in Spain. His attainments have caused him to be preferred to all the pilots who navigate to the Western Indies who were not able to exercise their employments without his license and for that reason his title is Chief Pilot." The ambassador writes of an interview he had with Sebastian in regard to sea-trade of Venice, "I have some slight knowledge of geography and considering the position of Venice can see no way whatever by which she can undertake these voyages;"¹ that is those in the Atlantic.

⁷ Pp 254, 256 v 1 Nav Colec; pp 131, 135, Sel Let. Other statements in this place are inexplicable.

⁸ Ravenstein Behaim and His Globe p 88: above pp 271, 279.

⁹ P 223 Jour Columb Hakl.

¹ These letters are in the v cited note next preceding; in which is included also Papers Rel to Voy of Cabots. A map made by S Cabot has been preserved; see pl 36-39 Mon de Geog Jomard 1822. On it are several ships: all have 2 masts with 2 sails on each, no topgallant sails; the after mast has lateen-yard only; under the bowsprit is a large square sprit-sail. In the Atlantic in long 325° reckoned all the way around east from the Canaries is a north and south line, it comes a little seaward of the mouth of the Amazon. On the west side of this is a Spanish and on the east a Portuguese flag and this legend, "The Kingdom of Spain and of Portugal;" and a little east again, "The meridian where the needle points directly to the north."

John Cabot the father of Sebastian was a Venetian and went to England with his family. On a map Sebastian made in 1544 this legend appears on Newfoundland, "This land was discovered by Joan Caboto Veneciano and Sebastian Caboto his son in the year from the birth of our Saviour MCCCCXCIII (should be 1497) on the 24th of June in the morning to which they gave the name of Prima Tierra Vista x x." In the Privy Purse Accounts of King Henry VII is stated this reward for Cabot; "10th Aug 1497. To hym that founde the new isle £10."² Columbus complains he was not rewarded by his royal patrons but Cabot was worse treated. John Cabot in his voyage to Newfoundland, "Entrusted his fortune to a small vessel with a crew of 18 persons and set out from Bristol;"³ from this and payment of \$50 came England's interest in America.

COLUMBUS.

Preceding sailing Columbus wrote, "I shall make a new chart of navigation in which I will place the seas and lands of the Ocean in their proper bearings and moreover I shall make a book and put in it everything as in a picture with its latitude from the equinoctial and *longitude* west. I shall accomplish much forgetting sleep that the navigation be well performed which will entail much labor."⁴ He seems never to have made the map. The first maps of the area covered in the Great Voyages are less accurate than the portolano-maps of Europe and seas made 200 years earlier: compare for instance the map *la Cosa* made 1500 and the *Carte Pisane* of 1300 both remarked on above.⁵ *La Cosa* though the date on his map is only 8 years after he reached the West Indies shows a promontory which must be Cape S Roque in Brazil—it was April of the year of the map that Cabral sighted Brazil—Domenica La Espanola Guadalupe Cuba and other islands in the West Indies and a coast line running away north beyond an island he marks *Frislanda* north of the south end of Greenland.

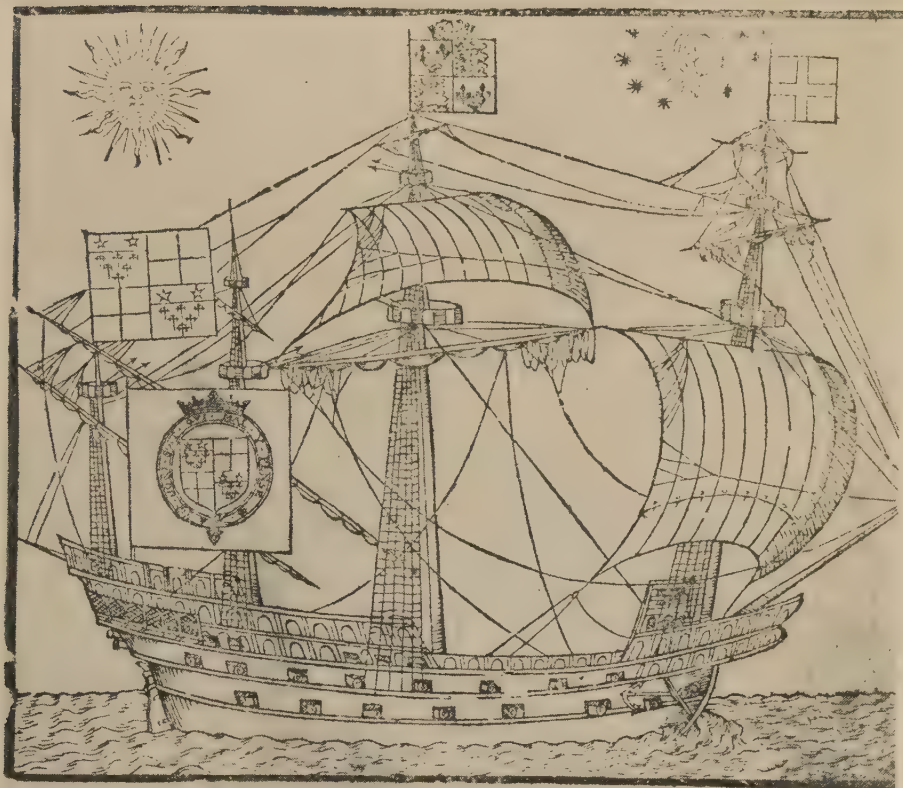
² See v mentioned note next preceding pp 212, 221, 200, 201. The *Real Titulo de Piloto Mayor con Extensas Facultades à Amerigo Vesputio* of Aug 6, 1508 and prior to Sebastian Cabot's appointment as Chief Pilot is p 299 v 3 Navar Colec. It is long and interesting; pilots, "Are to be instructed and to know what is necessary of the quadrant and astrolabe (no other angle-measuring instrument is mentioned) both the practical and theoretical. xx Without this no-one can go in the ships. xx Our Chief Pilot shall order and make xx a general chart to be called the Royal Chart:" see above p 295.

³ V cited p 203.

⁴ Journ Hakl p 18.

⁵ Pp 297, 545. *La Cosa's* is frontispiece v 2 Fiske Disc America; *Carte Pisane* p 297 above.

¶ A Regiment for the Sea: Contey-
 nyng most profitable Rules, Maibe-
 matical experiences, and perfect knowledge
 of Navigation, for all Coastes and Coun-
 treys: most needfull and necessary for al sea-
 faring men and Trauellers, as Pilotes,
Mariners, Marchants. &c.
 Exactly deuised and made,
 by William Bourne.



¶ Imprinted at London, nigh vnto the three
 Cranes in the Vintree, by Thomas Dawson,
 and Thomas Gardiner, for Iohn Wright.

This is the frontispiece in Bourne's Regiment of the Sea printed first 1570 about. She has four masts, the two forward carrying square course topsail and topgallant sails and two after large lateen-sails, on one a square sail was above this. She could not have carried jibs forward or other stay-sails. The courses had bonnets laced to their foot and no other means of reefing appears. All masts are supported by shrouds and on these ratlines appear. Running rigging of usual kind appears.

Half way to his extreme north he marks in the sea off the coast *Mar Descubierta por Ingleses*. But the most striking feature of Cosa's map is that the promontory which must be S Roque—it is not given a name—and the Cape Verde and Azore Islands are in about their correct relative positions in *longitude*.⁶

THE SHIPS OF COLUMBUS AND HOW THEY WERE RIGGED.

When Columbus' ship's-company thought they saw land October 11, the Journal reads; "When they had said the Salve which all the sailors were accustomed to sing in their way the Admiral admonished them to keep a good look-out on the forecastle (*buena guarda al castillo de proa*). At 2 hours after midnight they saw land. x x They lowered all the sails⁷ and remained with the *treo* which is the mainsail without its bonnets⁸ and lay close by the wind until the morning Friday when they arrived at an island called in the language of the Indians Guanahani."

In a letter Columbus says, "The crews were worn with the hard life and passing water;" and in another, "The sea was very heavy and I was obliged to return under bare poles (*sin velas*). I anchored at an island and lost 3 anchors there x x; the cable of the other ship parted and she drifted down on us x x. At the end of 6 days the weather having improved I resumed our route but now my tackling was lost the ships pierced with worms like a beehive and the crews paralysed and in despair x x. In 8 days I reached Jamaica always with a scant wind (*viento escaso* or *puntero*) and the ship in terrible condition. With 3 pumps and kettles and pots the whole crew could hardly keep down the water x x."⁹ In the

⁶ To show the way of writing numbers it may be added that not far north of S Roque La Cosa wrote on another promontory in South America, "This cape was discovered the year *mil y IIIIXCIX*" (1499). To cipher must have been a labor.

⁷ *Amanaron todas las velas*. It appears clewing-up sails and leaving them so was unusual; there are however pictures of ships both with the sails clewed-up and hanging loose and with them furled on yards still aloft. There are also shown ratlines on the shrouds for men to go aloft; but I cannot remember ever having seen foot-ropes along under the yards by which men now go out on yards to furl loose and reef sails. To show yards were lowered Pigafetta writes of Magellan's ship off the Cape of Good Hope when coming home, "To double the Cape of Good Hope we went to 42°S (the cape is 34°); they went so far to avoid Portuguese ships who were hostile and were 9 weeks off the cape with sails *amenées* because of the west and north-west winds xx." *Amener* is to lower *carguer* to brail or haul up; see Prem Voy trans Amoretti p 226.

⁸ The Spanish is *treo que es la vela grande sin bonetas*. When the bonnets were off the mainsail was called *treo*: there appears to have been no way of making this sail still smaller: the next step was to go under bare poles.

⁹ Nav Colec v 1 pp 20, 199, 305: Sel Letters Hakl pp 36, 21, 195. See n 3 just below as to pumps.

Journal Feb 13, 14, 15 when near the Azores returning to Spain, "From sunset until morning there was a heavy gale and great seas. There was lightning to the N N E a sign of strong wind from that quarter or the opposite. We were under bare poles (*arbol seco*) most of the night. x x The next evening the wind increased and the sea became very heavy. I carried the mainsail *very low* (*llevaba el papahigo muy bajo*) so as only to keep the ship ahead of the sea.¹ x x The wind and sea increasing we ran with the wind astern wherever it drove us; the caravel Pinta began to run too and disappeared although all the night the Admiral showed lights and she answered x x. We steered that night N E by E. At sunrise there was a terrible cross sea. We carried the mainsail alone *and low so the ship might escape the seas.*" During this gale Columbus wrapped an account of the voyage in a water-proof envelop in a barrel and threw this overboard.

In the Journal for October 24 is written, "I set all the sails in the ship the mainsail with 2 bonnets x x." Following at the place broken off in the last paragraph is written, "With showers and squalls the wind came out west and we ran with the wind astern and the fore course alone. x x I had taken the *bonnet off* for fear everything should be *carried away by a sea.*"² x x After sunset the sky cleared towards the west; x x the Admiral added the bonnet to the mainsail."

The first thing done when sail was to be shortened was to furl the top-sails, next the lower yard was lowered and the bonnet taken off the course or both bonnets if there were two. Two are shown in a map of Diego Ribero of 1529.³ How the bonnets were taken off and on in rough weather without danger must remain a mystery. The main-yard of the Santa Maria in which ship Columbus went his first voyage must have been

¹ Just below is mention of 2 bonnets on the mainsail: these were laced to the foot and when off the yard was lowered though perhaps not the full depth of the bonnets: the vessels were often boarded by a sea and it was necessary to let the water go under the sail.

² This means the foot of the sail was higher by the depth of the bonnet or nearly so much to let the sea go under, the yard not lowered.

³ Nordenskiöld Periplus pts 48, 49: a number of ships appear; all have 3 masts 2 square and 1 fore-and-aft rigged; on each sq-rigged mast are 2 sails; the main-course of one ship has 2 bonnets laced to it and the fore-course 1. Ribero was a versatile person: by royal order of June 10, 1523 he was appointed, "Cosmographer to His Majesty and Master of Making Charts Astrolabes and Other Instruments of Navigation:" by royal order in 1531 the Casa de Contratacion was to examine Ribero's new metal bilge-pump for ships: the Board reported favorably Oct 16, 1533 but Ribero had already died; see Navar Colec v 1 p CXXIV.

as much as 30 feet long. If lowered until the entire sail was on the deck and there smothered the bonnets could be taken off or put on without danger of throwing the men about the deck or overboard. Or the sail might be clewed up and the bonnets taken off or put on then by men on the yards. Bonnets were probably laced the way we lace extra pieces on sails. There is evidence both for and against belief sails were reefed as now, by tying a part to a yard; (1) In *Les Costumes au Moyen Age d'Après les Sceaux* Demay will be found illustrations of European ships from seals of the 13th to 15th century and some show sails with reef-points like those we use. In one seal only, that of the city of S Sebastian of 1335, is there a ship having ratlines on the shrouds, a thing necessary if men are to go aloft to handle sails; (2) no word appears in the record left by Westerners indicating the use of our reef-points, while in the *Lendas da India* of Correa a Portuguese long in India in early days, is a description of native vessels their sails and how these are reefed; the last being the way we practise.⁴ Correa must have known how Portuguese and other western ships reefed and would not have described the way in the East if it had not been a novelty: he went to India 1514, was in the service of vice-roys there, and sent his manuscript home about 1580.

To show ships were as now sometimes in less danger at sea than in harbor Columbus' Journal of Feb 20 may be cited, "There is no good port in any of the Azores for the weather they then experienced, and there was no remedy but to go to sea." As he approached the Azores homeward-bound he writes, "The Admiral said that his navigation had been very certain and that he had laid down the discoveries on the chart. x x He was sure he was in the region of the Azores and that this was one of them. He pretended to have gone over more ground to mislead the pilots and mariners who pricked off the charts⁵ that he might remain master of the route to the Indies as in fact he did: for none of the others kept an accurate reckoning so that no one but himself could be sure of the route to the Indies."

There is this in the Journal for Sept 25, when 19 days out from the Canaries but not yet in sight of the West Indies, regarding a chart

⁴ Pp 323-44. Three Voy Gama Hakl. This is part of Correa's work only; the entire *Lendas* in Portuguese is in large libraries. The ship in picture p 557 above shows a bonnet on foresail and no other means of reducing sail.

⁵ *Pilotos y marineros que carteaban*. *Cartear* now means to steer by chart; *compasar* to measure and prick a chart; *compas* means dividers. The words are no doubt as Columbus wrote them.

Columbus had with him, "The Admiral conversed with Martin Alonso Pinzon captain of the other caravel *Pinta* in regard to a chart which he had sent 3 days before to the caravel there being certain islands painted in that sea. Martin Alonso said these should be where the ships were now; the Admiral said so it appeared to him but it might be they had missed them because of currents which here set ships to the N E and that these had not been so strong as the pilots said. The Admiral asked that the chart be returned to him and it was sent *on a line*. The Admiral and his pilots began to measure and prick on it." This chart is said by some to have been made by Toscanelli a Florentine astronomer and around it has gathered much controversy. Fiske in his *Discovery of America* Winsor and others say Columbus had Toscanelli's map and give copies of it.⁶ Vignaud in Toscanelli and Columbus denies the tale in toto. The chart has never been found but there are allusions to one in Las Casas and other contemporary authors and from these the chart has been drawn. On it is shown an island called Antilia 1200 miles west from the Canaries whence Columbus took his departure. There is no island there; Columbus and Pinzon expected however to find one. It does not signify much who made the chart the ships evidently had, though it would be interesting to learn how the pilot or cosmographer who drew it came to put an island where he evidently did put one. How did Pinzon send the chart to Columbus; the ships came close and one threw a line to the other and the chart was hauled over in a covering.

This chart was probably the first to show the part of the world from Europe west to Asia and it matters little whether the one shown in modern books was the one Columbus had. He had a chart, no matter of wonder that, and expected to find an island 1200 miles west of Gomera. The reproduced chart shows an island here and names it Antilia; as respecting its correctness it may be added that 2200 miles west of the non-existent island Antilia is placed the north part of Cipango. Cipango, Japan, is depicted 3300 miles west of the Canaries extending from 30° to 5° N latitude. West from the north of Cipango and distant 750 miles is the city Zaiton and the province of China called Mangi: Zaiton the great sea-port of Cathay is thus 4000 miles west from the Canary Islands and about where the city of Austin in Texas is. China is moved 7000 miles east, ¹/₃

⁶ P 356 v 1 Fiske. The chart accompanied a letter said to have been addressed by Toscanelli to Columbus: the letter is given by Fiske Winsor and others. See pp 547-8 above for the source from which this chart and letter comes.

around the globe. How the learned made such mistakes it is impossible to say. A letter said to have accompanied Toscanelli's map now exists, though some who have examined the evidence deem it fraudulent; it depends Vignaud thinks upon mistakes and falsehoods into which he goes at length; ending with the words, "The cosmographical system of Columbus dates from after his discoveries. The author of the letter x x cannot be Toscanelli who died in 1482. Columbus when he embarked on his great enterprise had no scientific theory whatever."⁷

It cannot be determined what was in Columbus' mind when he sailed. He found America though searching for Asia and his part is held the greatest in a great event. Vasco Da Gama had his facts spread before him; Dias showed him the way round the Cape and travellers had visited the East and sent him intelligence from Arab seamen that when around the Cape he must land and enquire how to steer to India.⁹ Magellan had been to the Far East, almost to the Moluccas, by way of the Cape of Good Hope before he sailed to go there going west; and had no doubt personal convictions how far he must go to the Strait if there was one and on to the Spice Islands. He left no writings but the log of his ship shows he became worried at not reaching his destination after sailing a great distance across the Pacific. If Columbus was a learned pilot, a cosmographer as geographers were called in his day, he should have known as well as Magellan how far he had to go. He should have known that west from Spain to Manzi and Zaiton is 10000 miles; and we must suppose he thought there were islands in the Atlantic like Antilia at which his ships would find food and water. It cannot be explained and must be admitted the venture was a desperate one. How he could have believed his ships within 10 days' sail of the Ganges when on the coast of Darien can be explained only by concluding his knowledge of cosmography was very deficient.²

There remain passages showing what Columbus' ships and life onboard them was. In the Journal of December 18 a cacique is said to come onboard, "When he came onboard," Columbus narrates, "He found

⁷ Toscanelli and Columbus Vignaud p 107. See also his Hist Crit Colomb, and p 544 above.

⁹ Pp 564-5 below.

² P 544 above. About 200 B C the distance west from Spain to the East was determined to be 172000 stadia; 17200 miles if we take 10 stadia to a mile, 13700 if 8 stadia to a mile; see above pp 226-30.

me dining at a table under the *castillo de popa*; ³ at a quick walk he came to sit down by me x x. When he entered under the castillo he made signs the rest should stay outside and they all took seats on the deck (*cubierta*) except the men of mature age who I took to be his counsellors and tutor (*ayo*). x x I saw he was pleased with a coverlid on my bed so I gave it to him x x." On another accasion to entice natives to approach in their canoes Columbus says he, "Ordered a tambourine brought on the *castillo de popa* and some young men to dance there x x," but the natives thought this sign of war and discharged arrows at the ship. Then Columbus had up men with cross-bows (*ballestas*).⁴ There is a similar tale about the Victoria Magellan's ship: the King of the Molucca Islands comes onboard to pay his respects, "We conducted him to the *gaillard d'arriere*," says our authority, "Where not to be obliged to stoop he wished to enter only by the opening from above. There we seated him in a chair of red velvet x x and to show our respect we seated ourselves on the floor opposite him."⁵ There is no reason to suppose space inadequate because the King would have to stoop to enter the cabin; some ships are so now.

Besides the *ballestas* hand cross-bows which were in Columbus' ships there were hand fire-arms for the Journal of Dec 26 mentions, "A lombard and hand-gun;" the lombards were of considerable power for in the Journal of January 2 desiring to show King Guacanagari the force of his artillery Columbus, "Ordered one of his lombards to be loaded and fired into the side of the ship that was onshore. The lombard-shot x x passed through the side of the ship and went far away over the sea." The ship used as a target was Columbus' own, Santa Maria: she was a wreck onshore.

VASCO DA GAMA.

Da Gama sailed from Lisbon 1497 with a fleet of 4 vessels ⁶ one a store-ship. Excepting the smallest they were about 90 feet long; they had 3 masts 2 carrying square and one fore-and-aft sails, lateens. On each square rigged mast there were 2 sails a course and topsail the former

³ The castle of the poop was higher than that at the bow. These decreased very much the sea-worthiness of ships. In the after castle lived the principal officers and distinguished passengers; the helmsman and pilot were stationed in it.

⁴ Things were comfortable; Columbus dined under the castle at the stern, more lofty but otherwise like poops now, and had a handsome coverlet on his bed.

⁵ Prem Voy Trans Amoretti p 164. *Gaillard d'arriere* is the *castillo de popa*.

⁶ Above p 311 n 8 for where pictures of these are.

having bonnets. Topsails, at present carried more and longer than courses, were used only in fine weather and were small. The course was deep and did not stand flat; consequently ships could not lie near the wind. No doubt as with sails of Columbus' ships the course was called *tree* when the bonnet was off and the yard lowered somewhat but left high enough to allow seas coming onboard to pass under the sail.

Da Gama had experience at sea before he sailed⁷ but it may be doubted whether he was a seaman in the sense Dias and Magellan were. The arrival of his ships in the East is an event of great interest, for though we have reports of meetings of ships of the East and West at earlier date they are very few and the cases are separated by intervals of centuries, while numbers of ships from Europe followed Gama immediately. He was made Vice-roy of India by the King and his name is connected with the origins of the Ocean Empire in the East held by Portugal for 100 years; until the Dutch and English arrived out. These last struggled long in cold wild weather in high latitude to find a way to the East by the north-west or north-east; not because they feared Portuguese hostility if they went around the Cape of Good Hope but because the distance is less by the north. When it came to be recognized the ice was insuperable, an Englishman James Lancaster with, "Three tall ships" fitted at private expense and risk in 1591 rounded the Cape of Good Hope bound to India.⁸ Nearly all exploration and extension of relations were made in Spain Portugal and France by Government but in Holland and England by private effort. It may be doubted whether the Dutch French and English ship-captains who soon came to the East in great numbers much heeded the Portuguese and Spanish claims to monopoly, but these were very real before Lancaster came out, for Spain in 1580 seized Portugal and her belongings, thereby becoming master of the route to the Indies by both east and west by the Cape of Good Hope and Cape Horn as well as that other much frequented way across the Isthmus of Darien.

Da Gama's voyage was not an act of devotion in the way those of Columbus and Magellan were. These last expected to encounter dangers impossible to fore-tell and almost single-handed originated plans, procured means to carry them out, and went forward. Da Gama's voyage was laid out in advance. Dias had been around the Cape of Good Hope 10 years

⁷ Castanheda *Hist Indes* trans Grouchy p 5, "He had great experience in affairs of the sea;" also *First Voy Da Gama Hakl* p XIV.

⁸ Lancaster *Voy Hakl*.

before and accompanied him as far as beyond the Cape Verdes to show him the way, returning thence to Portugal to sail 2 years later with Cabral.⁹ Pero d'Alanquer who had been with Dias around the Cape was pilot in Da Gama's ship the S Gabriel, and Diogo Bartholomeu's brother was *escrivao* writer or clerk in her.¹ Diogo commanded the store-ship of his brother's squadron when the Cape was discovered; Barros writes,² "The supply ship had for captain Pero Dias brother of Bartholomeu Dias." Gama had many sources of information until around the Cape and well and with high courage he used them: after leaving the Cape Verdes, "The first land at which he touched before arriving at the Cape of Good Hope was a bay called Sancta Helena it being 5 months since he left Lisbon; here he landed to get water and take the altitude of the sun."³ This allowing a month for the ships to reach the Cape Verdes and to lie there a time, leaves 120 days from the Cape Verdes to St Helena. Castanheda makes the passage 90 days and agrees with Barros that Da Gama went by the open sea rather than close to Africa where the wind is baffling. Castanheda says,⁴ the squadron being at the Cape Verdes, "The 3rd of August the captain-general sailed x x and pursuing the voyage took the route to the East direct for the Cape of Good Hope and with all his ships entered into the open sea where he navigated the months of August September and October x x. The 4th November they saw the land which greatly rejoiced them. All the captains saluted the captain-general being dressed in holiday clothes and the ships flying flags and pennants; x x they gave to the land the name of S Helena."⁵

Gama had sailing-directions for the Atlantic from Dias enabling him to reach the Cape without breaking down his crews by working ship for months in the baffling winds of the pestilential region near the coast of Africa. The ancient Greeks would have called it Periplus of the Atlantic: it was adopted at once, Cabral Albuquerque Da Gama in a second voyage,

⁹ Above p 537.

¹ Barros Asia 1, 4, 2. The *escrivao* was a person of consequence usually appointed by the King; his office was to keep a true record.

² Asia, 1, 3, 4: a confusion in a name appears.

³ Barros, 1, 4, 2,

⁴ Hist Inde Fr trans p 6. Correa Lendas da India is very indefinite about the route. He does not mention their touching between the Cape Verdes and the River of Mercy east of the Cape; see his chaps 7, 8, 9, 10. In the Eng trans it is pp 35-75 Three Voy Da Gama Hakl.

⁵ The ceremony took place on reaching the coast of Africa but we shall soon find mention of games on crossing the equator.

all went that way in the following 2 or 3 years and it is still followed. Beyond the Cape Da Gama had directions to land and enquire the way to India. Arab ships did not usually come south and west to the Cape, fearing the Agulhas Current as we call the stream running west around the Cape, and the Portuguese found pilots only some distance east and north. This current was known however and ships must have been in it and recognized it for Marco Polo heard of it from eastern sailors 200 years before Da Gama's day and Barros the historian calls the Cape of Good Hope in one place Cape of Currents.⁶ Perhaps Polo's book was not read in Europe but the current is on the map of Fra Mauro made in Venice in 1459, which Gama may well have seen. There is a legend on this map stating in 1420 a vessel of India was blown S W 2000 miles beyond the Cape.⁷

The King of Portugal obtained other information in respect to the sea-route to India. Messengers had been despatched east by land, and these after reaching Jerusalem returned with report that messengers must speak Arabic. So in May 1487 a year after Dias sailed Pedro de Covilham and Alfonso de Payva who possessed this qualification set out. The last died presently but Covilham went in an Arab ship to India and visited a number of cities. He went to Sofala on the east coast of Africa opposite the middle of Madagascar in latitude 20° S, to inquire about this island called Island of the Moon. Returning to Cairo and finding merchants going west he sent his master a report which includes the following; "Ships which sailed down the coast of Guinea might be sure of reaching the termination of the continent by persisting in a course to the south. When they should arrive in the Eastern Ocean their best direction must be to inquire for Sofala and the Island of the Moon."⁸ The report of Covilham, Chart of Fra Mauro, and chart on which Dias depicted his voyage before the King and in presence of Columbus⁹ must have been in Gama's ship and studied before the fleet sailed. There must have been onboard also a copy of the Book of Marco Polo as the great Venetian had 200 years before been in the seas Da Gama was to enter.

⁶ Cord Yule's *M Polo* v 2 p 412; also note 4 p 415.

⁷ *N 5* p 417 Polo.

⁸ Major Life Prince Henry p 339. Few have lived such strange lives as Covilham. From Cairo he went to Ormuz at the mouth of the Persian Gulf and returned to Aden. He then passed into Abyssinia where the ruling potentate took a fancy to him and kept him until his death 33 years later. He married in Abyssinia occupied important posts and amassed a fortune.

⁹ Above pp 532-3.

THE SAILING ROUTE TO INDIA.

Following the first voyage of Da Gama Cabral sailed in 1500 Da Gama a second voyage in 1502 Albuquerque¹ in 1503 and others in number, all going the way pointed out by Dias. Going forward in time we find the route written out: in 1583 a Hollander John Huyghen Van Linschoten sailed from Lisbon in a Portuguese ship with, "Five ships of the burthen of 14 or 16 hundred tunnes each ship commonly charged with four or five hundred men. x x x When past the equinoctial we find a wind they name a general wind, it is a south-east wind and we must always lie side-ways in the wind x x because that upon the coast of Brazilia about 18° on the south side lieth shallows which the Portugalls call *Abrashos* that reach 70 miles into the sea. To pass them the ships hold up most unto the coast of Guinea and so pass the said flats, otherwise if they fall too low they are constrained to turn again unto Portugal x x. Therefore men must take heed to shun the calms and storms and keep themselves from coming too near the coast of Guinea and also not to hold too far off thereby to pass the flats and shallows, wherein consisteth the whole Indian voyage. x x We passed beyond the aforesaid flats of Brazilia x x and then the general wind served us until we came to the river Rio de Plata where we got before the wind to the Cape de Bona Speranza." In the account of this voyage the ceremonies usual when crossing the line are described.²

Linschoten sailed from Cochin in the *S Maria* in 1589 and gives details of how the people lived in the ship and their duties; he says, "The Pilot hath his cabin above in the hinder part of the ship on the right hand side where he hath 2 or 3 rooms and never cometh down but standeth and commandeth the Master of the ship x x. The Master hath his cabin in the

¹ Com Dalboquerque Hakl: Albuquerque, Stevens; p 109, 3 ships are sent from India to explore Moluccas in which went Magellan; p 122, letter of Alb to King, "The Moors know well a dominion founded on a navy alone cannot last."

² Voy Linschoten Hakl v 1 pp 9, 10, 15, 16, 18. The *Abrolhos Shoal* is correctly placed. The directions given show how much less weatherly were the ships of the day with their flowing sails than now, when principally by more sails each stretched on its own yard sails stand flat. It is clear the ship held up too far east, far enough to be in the calms near the coast of Africa from fear the S E trade might force her too near S America. A modern ship would cross the Line further west than Linschoten's and thus clear the calms and squalls of the coast of Africa running with the N E trade nearly astern. There are other eds of Linschoten; one in French printed in Amsterdam in 1619 but copies of the work complete are rare. It is of high interest in seafaring, containing routes to many places maps and other data. See v 2 p 234 as to passage of the *S Maria* home from India in 1589 narrated immediately below.

same place behind the Pilot's cabins on the left hand x x where he standeth and commandeth with a silver whistle" x x. But, "Not any of them will do more than belongeth to his charge and what further is to be done they will stand and look upon it." Also we read, "There were divers sailors in the ship that likewise had their charts and instruments some to learn other for their pleasure."³ The *S Maria* came outside all islands from India to the Cape the, "Pilot being the first that took upon himself to discover that way x x." The pilot was, "Cast into prison" for this but soon released as the voyage was successful. They saw no land from India to the Island of St Helena rounding the Cape by soundings 125 miles south of it. They were 109 days from India to St Helena Island. The sea ways of these days negatives the notion that ships were steered at random. The *S Maria* had been 80 days at sea with no longitude but by dead-reckoning and with this and soundings off the Cape altered course from west to north and never saw the land; some 1200 miles further on she made and reached St Helena. Unless the ships went where they were wanted to go like those of the Phoceans,⁴ we must take off our hats.

William Dampier wrote as to rounding Good Hope about 100 years after Linschoten, "There is good sounding off this Cape 50 or 60 leagues at sea. But the greatest dependence now of our English seamen is on their observing the variation of the compass which is minded very carefully when they come near the Cape by taking the sun's amplitude mornings and evenings. This they are so exact in that by the help of the azimuth compass an instrument more peculiar to the seamen of our nation they know when they are abreast of the cape or either to the east or west of it. For that reason though they should be to the south of all soundings or fathomable ground they can shape their course right without being obliged to make the land. But the Dutch on the contrary having settled themselves on this promontory do always touch here in their East Indian voyages both coming and going."⁵ In a letter of Sir Wm. Monson to Martin Frobisher dated July 1592 we read regarding Portuguese car-racks for India, "Since their departure from Goa in the Indies they never

³ Work cited note next preceding pp 228, 231, 177. No modern sailor would do this: possibly because his chance to use such knowledge for his benefit is slight. The writer was told by a New England seaman 50 years since he went to sea with 15 young men some years before and all commanded ships by reaching 25 years of age.

⁴ Above p 67.

⁵ Dampier's *Voy* p 512 v 1; the work is identified p 665 n 7 below and other things in it are pp 665-68 below.

see St Helena the Island of Terceira in the Azores nor any land till they fall with the coast, for so is their directions on pain of death from the King x x." ⁶ The letter was written to enable Frobisher to intercept and capture a carrack homeward-bound. The ships of the fleet in which Linschoten sailed for Portugal as recounted in January 1589 were to start as soon as ready and wait for each other until the 25th May and no later at St. Helena. Thence they proceeded in company for better defence against rovers.

DA GAMA AGAIN.

The basis of Hakluyt's Vasco da Gama's First Voyage is a *roteiro* a log written by an unknown person. The Three Voyages of Da Gama Barros' Asia and Castanheda have also been referred to. None gives much information as to sea affairs. The *roteiro* is very different from Columbus' journal or the *diario o' derrotero* written by Albo the pilot with Magellan to whom we come presently. The *roteiro* contains no latitude or longitude no distance run nor course and it is hard to believe it written by a seaman, and the other works mentioned are hardly more informing. Each tells something of the preparation and sailing of fleets and little more, but the ships the way they were rigged and the ways onboard them must have been the same as in Columbus' day.

Chapter 8 of Correa's Lendas is entitled Of the Navigation Which the Ships Performed and Of the Storms Which They Underwent until They Doubled the Cape of Good Hope Which They Did not See. This was Da Gama's first voyage out; the ships were long off the Cape struggling against the current and Correa says the men became demoralized, "Begging with tears and cries to put back the ships." Da Gama when his ship was spoken regarding this, "Answered that he would hold a consultation with the pilot and his crew and that whatever he determined to do he would make a signal of his resolution." Then he ordered the men in his ship who were complaining to draw up a document giving reasons for putting back. It need be signed he said only by those who understood the business of the sea; and having given these directions he retired to his cabin ordering the men who had signed to follow him: these he, "Ordered to go down below to another cabin which he had beneath his own for a store-cabin x x and summoned the master and pilot and ordered them below also telling them to go and sign x x. Then he called them up one

⁶ Nav Tracts Monson Navy Rec Soc v 2 p 376.

by one and ordered them to be put in irons by his servants in the cabin and heavy irons for the pilot and master. All being well bound and ironed the captain-major turned them out ordering the master and pilot at once to give up to him all the articles which they had belonging to the art of navigation. x x Then Vasco da Gama holding them all in his hand flung them into the sea and said,—‘ See here men you have neither master nor pilot nor any-one to show you the way from hence-forward.’ Seeing and hearing these things the crew became much more terrified x x not having either pilot or master nor any-one who knew how to navigate a ship.”⁷

There are 2 more passages of interest: one is mention of the *porpao* or *prepao*, fife-rail we say, the rail on deck around the foot of the mast which carries pins to which ropes are belayed. To this Da Gama once ordered a man tied when about to torture him to extort the truth.⁸ The other point is in regard to women onboard: in his third voyage 1524 Da Gama ordered before leaving Portugal no women were to go. This was proclaimed onshore and posted at, “The foot of the masts any woman found onboard would be publicly scourged even though she were a married woman and her husband sent back to Portugal loaded with fetters.” Three women went notwithstanding but were not found until Goa was reached and though many interceded Da Gama would not relent and they were publicly flogged.⁹

Women were in the ships often, nearly always probably. Ponce de Leon whose name is connected with hoped-for fountains of youth reached Guadalupe from the Canaries in 1515 and it is related, “Ponce had sent some women ashore to wash x x and also some men to obtain fresh water for he had not seen land after leaving the Island of Ferro in the Canaries until he reached Guadalupe a distance of 4200 miles. There is no island in the ocean throughout the entire distance.”¹ In a letter of Philip of Spain regarding the Invincible Armada the ration of wine for the men is diminished the King commands the men to confess and

⁷ P 63 Three Voy Da Gama Hakl. This story is usually discredited but gives idea of what one who lived long in India deemed life onboard ship was. Osorio Hist Port in Reign Emmanuel says p 48 Da Gama was solicited to return and discovering a conspiracy, “Put all the pilots in chains and himself with some others performed that office.” Osorio wrote about 1571 and had excellent opportunity of learning the truth.

⁸ P 363 work cited.

⁹ Work cited note prec p 395; a foot-note adds Da Gama sent the women dowers when on his death-bed.

¹ P 401 v 1 Orbe Nova Martyr Eng trans. Ferro is 10° north of Guadalupe; the straight distance between them is not more than 2500 miles.

communicate before embarking and directs that no woman shall be allowed to embark.²

MAGELLAN.

Magellan sailed from San Lucar de Barrameda the port of Seville Sept 20, 1519 in the service of the King of Spain with 5 ships; San Antonio Trinidad Concepcion Victoria and Santiago; the first two rated 120 and 110 tons, Concepcion and Victoria 90 and 85, and Santiago 75. When they sailed Magellan was in the Trinidad but later the Victoria which 2 were the only ships that reached the Spice Islands. From here the Trinidad made unsuccessful attempt to return east to New Spain now Mexico and the Victoria went on west and made the circuit of the earth Magellan having been killed in a fight onshore in the Philippine Islands.

The ships were of the build and rig of those of Columbus and Gama and as to the state of the hulls we have the following, "They are very old and patched; x x their ribs are as soft as butter."³ Many ships of the day were what seamen call *crazy*, working and leaking in a manner hard to believe. In an illustration in De Bry the harbor of Lisbon is shown as of date 1600 and ships have a heavy rope around their hulls just below the upper rail to lessen opening when they worked. Magellan's ships had 2 masts carrying a square course and topsail and one fore-and-aft mast aft; and sail was shortened or made in the ways already mentioned. The equipment in guns and navigational appliances has been given.⁴ No better picture of the ships is to be found than that of the Victoria on the outside cover of the publications of the Hakluyt Society. Some believe the ships could not beat but there are many mentions of their tacking and beating. The heavy ships did not lie as high as modern ships do nor did they fore-reach much in stays but they could gain to windward. The fore-and-aft caravels were very weatherly and would give a modern schooner a tussle in a thrash to windward. Neither the western world nor modern days have monopoly of capable sailing-craft for nothing can out-class the *proa* of Polynesia.

Magellan was Portuguese by birth and went first to the Far East

² Armada Invencible Duro v 1 pp 425-6. P 414 this v are the words of the Duke of Medina Sidonia declining the King's selection of him as commander of the armada; "It is not just that I who have no experience of the sea or of war should accept it" he wrote; he commanded however.

³ Guillelmeard's Magellan p 119: the words are of an unsuccessful contractor and may be exaggeration.

⁴ Above p 348.

in the service of Portugal in the squadron of Almeida sailing from Lisbon 1505, and went beyond India in a squadron despatched by Albuquerque when vice-roy. This led to his being present when Malacca was captured, on which occasion fabulous treasure was taken for Malacca was a place where ships congregated and cargoes were trans-shipped. Here Magellan's career was decided for he went onward to find where the cloves grow; he commanding one ship and Francisco Serrano another.⁵ The ships were separated and Serrano, "A great navigator and friend of Magellan,"⁶ reached Ternati or Tidore one of the Moluccas after losing his ship and Magellan reached near-by islands.

From here Magellan returned to Portugal, where he was in the year 1512 apparently without again seeing Serrano who remained in the Moluccas; but his interest in the islands did not flag: "For more than 9 years Serrano remained at Ternati and Magellan whose ship had been driven to an island 600 leagues east of Malacca,"⁷ maintained a correspondence with him x x discussing the geographical situation of the Moluccas. They were beyond the Limit that belonged to Portugal they said according to former charts made conformably with the Bull of Repartition of the Ocean. Upon returning to Europe Magellan became strengthened in these ideas continuing his correspondence with Serrano and consulting the pilots and astronomers of his own country"; so writes Navarrete.⁸ These circumstances gave rise to questions between Spain and Portugal which were long debated, and Magellan who took service with Spain before going on his voyage was abused by the Portuguese for abandoning his country. It would be of interest to know if he changed because convinced the Moluccas were beyond the limit of Portugal; were east of that part of the Line drawn by the Pope which is on the opposite side of the earth; but while this is indicated by the records there is not proof of it. Barros who was Portuguese gives account of the correspondence of Magellan and Serrano saying the last,⁹ "Doubled the distance from Malacca to the Moluccas and made it appear he had discovered another new great world more remote and richer than that

⁵ Navar Colec v 4 pp XXV-LXXI Noticia Biog de Magal; Guillemard's Magel p 67.

⁶ Navar Colec v 4 p 371.

⁷ About the distance to the Moluccas from Malacca.

⁸ Navar v 4 p XXVIII. The friends were united at death; Navar note v 4 p LXXIV tells us, "Serrano died of poison by the Moors of Ternati almost at the same time Magellan was killed in the Island of Mactan."

⁹ Asia 3, 5, 6; v 5 p 599 ed 1777.

discovered by Admiral D Vasco da Gama. From which letters Ferdinand Magellan had new conceits which caused his death and put his Kingdom to great disappointment as we shall see."

Magellan left little record emanating from himself, while much that discredits Columbus purports to come from him directly. Magellan's good name rests on his deeds: we have an anecdote long preceding his great voyage; Herrera a Spaniard born 1549 writes,¹ "Hernando de Magallanes was a man of much experience at sea. At starting from India for Portugal 2 vessels he had with him went ashore but he saved all the people and most of the stores by boats. x x Upon sending for help x x the captains hidalgos and principal men wished to go first; the seamen and others said not without them. Hernando Magallanes seeing the danger was great exclaimed, 'Let the captains and hidalgos go I stay with the men.' The mariners and other private persons were content with this."

WHOSE WERE THE MOLUCCAS.

The voyage to the Moluccas in which Serrano and Magellan commanded ships was in 1510 and 9 years later Magellan sailed on his voyage west; he Serrano and others having estimated the distance to the Moluccas from the coast of Europe. This they did by dead-reckoning; *estimated* distance seamen called it, *estimacao* Portuguese said and Spaniards *derrota estimada*. The distance is almost wholly difference of longitude which could be measured only by ships' courses and distances.² Magellan Serrano and other cosmographers working with *estimacaos* made several times a day by ships going to India around the Cape of Good Hope and thence on to Malacca and the Moluccas, concluded the last were more than 180° east from the Line in the Atlantic; that they belonged to Spain.³ By the Papal Bull ships of Spain might not sail in Portuguese seas, that is around the Cape of Good Hope, and thus Spain wished to establish the route west from Europe. Magellan knew the circuit of the earth and the distance from Spain east to the Moluccas and therefore the distance west; unless an opening in America if there were one forced him to make a greater or less detour than anticipated.

¹ Hist Indias Occid 2, 1, 19.

² Pigafetta who made the voyage with Magellan states the circumference of the earth correctly (Prem Voy p 270): this and the quotation from Barros just above regarding Serrano's doubling the distance from Malacca to the Moluccas shows all estimates depended on dead-reckoning.

³ Below pp 594-96 and 598 and foll'g.

THE STRAIT BY WHICH TO PASS AMERICA.

Before Magellan's voyage the outline of America from high north to high south latitude was fairly well approximated and he was no doubt of the opinion he must go far south to find the strait. When we call to mind that Columbus raised the West India Islands 27 years only before Magellan sailed we must believe extraordinary promptness and perseverance had been exercised. As we have seen ⁴ explorers sent when Cabral re-discovered South America coasted large parts of it, the followers of Columbus and the great discoverer himself having previously passed along its northern parts and the Isthmus of Darien. In 1513 Vasco Nunez Balboa saw the Pacific from Darien and recognizing it a large body of water took possession for the Spanish Crown calling it South Sea. It was seen the land was narrow and a passage was hoped for. Balboa was in search of the reported wealthy kingdom in the south, Peru; and the coasts both south and north of Darien were over-run by the conquerors. By the time Magellan sailed the invaders were in possession of Peru and a great district north of Darien which came to be called New Spain. Even before this many must have suspected the truth, that a territory of great size had been found, for Vespuccius calls it *Mundus Novus* a New World in a letter written in 1503; saying in the same letter he will, "Go to the East by the south" and, "My last voyage I found this *continent* more inhabited with people than our Europe or *Asia* or *Africa*." ⁵ Yet Columbus believed until his death in 1506 he had reached Asia.

Peter Martyr says of Magellan, ⁶ "During his childhood he had vaguely heard discussed in Portugal the existence of a strait whose entrance was difficult to find." The first stage of oceanic exploration belongs to the Portuguese. In 1500 their ships were off the coast of Labrador and Newfoundland and near Cape Horn. Following Cabral in Brazil in May 1501 a squadron of 3 ships sailed from Lisbon to go further south and at the same date Gaspar Corte Real sailed for the north carrying, "A general license of the King Dom Manuel to go and discover a new land." Gaspar made 2 voyages to the north and as he did not return his brother Michael, "Went to seek him with 3 ships well

⁴ Above pp 539-40.

⁵ P. 113 Varnhagen's work cited n 8 p 574 below.

⁶ Orbe Nova Eng trans v 1 p 286. P 166 is his letter to the Pope after the Victoria returned to Spain. Martyr says he was a friend of Columbus; often had "Cabotto" and young Vespucci, "Nephew to Amerigo Vespucci who at his death bequeathed his knowledge of navigation and cosmography to his nephew" at his table to hear them talk.

appointed at his own cost:" he never returned; the brothers with their ships and crews perished.⁷ Of one of the ships sent south to explore beyond where Cabral had been Vespucci was commander. The squadron passed down the coast of South America nearly to the Rio de la Plata and thence steered S E into the open sea 500 leagues. Vespucci wrote, "We sailed so far in this direction that April 3d we were at a very high latitude beyond 52° S and at a distance of 500 leagues S E of the port we had left."⁸ Mr. Varnhagen says Coelho commanded this squadron, which was in Lisbon again September 1502. May 10, 1503 another squadron sailed, Coelho again in command and Vespucci commanding a ship.

This was 16 years before Magellan sailed and the object of the expedition was perhaps the same as his. Vespucci tells the story as follows, "We departed from this port of Lisbon 6 ships in company with the intention of going to discover an island situated toward the east and known as *Melcha*. This island is famous for its wealth because it is a stopping place for all ships coming from Gangetic and Indian Seas. x x On the 10th May 1503 we set sail and made for the Cape Verde Islands. We remained there 12 days. The commander of the fleet x x x issued orders we should make for Sierra Leone on the coast of Ethiopia x x. We resumed our voyage and crossing the equinoctial by 3° saw an island in the ocean."⁹ As it is stated *Melcha* is toward the east and the commander of the fleet ordered it steered toward Sierra Leone, that is east to the coast of Africa, it is impossible to tell whether they intended to go to *Melcha* by the old route by the east or to seek a new way west: whichever way they had in mind to go they knew they should pass near S America. Vespucci says that men had never before landed

⁷ Galvano Disc of World Hakl p 96: Doc Rel Gaspar Corte Real bound in Journal of Columbus Hakl pp 229-240; here is given in facsimile part of the Cantino Chart 1501-2. Away up north is the *Terra del Rey de Portugall*. It is a navigator's chart; for in left hand lower corner is this, "*Carta da navigar of the islands newly discovered in the parts of India; Alberto Cantino.*" It does not require long examination to satisfy one of dangers ships ran in the years before charts were accurate.

⁸ Above pp 539-40: also Vesp son Characteres etc Varnhagen Lima Peru 1865 p 110: p 120 is a chart showing Vesp tracks; they extend from Ches Bay in N America to Island S Georgia in higher lat than Magellan Strait: see also First 4 Voy Vespucci Re-produced etc Stradanus: also Navar Colec v 3 p 191: also Cosmog Introd Waldseemüller in Facsimile and First 4 Voy Vesp with trans into English. In the last is facsimile of the first map with name America on it and how the New World came to be so called; the date of the map is 1507: see Fiske Disc America.

⁹ This was Fernando Noronha 3° to 5° S and almost in sight from S America. The words are pp 41-4 First 4 Voy Vesp cited note next preceding: similar words will be found in the other works there mentioned. *Melcha* from the word and description must mean Malacca.

in Fernando Noronha and birds allowed themselves to be taken in the hands. Near or on Noronha the ship of the commander was wrecked and thence the remaining ships coasted America as far as the Bay of all Saints now called Bahia and kept on 260 leagues and planted a colony. Vespuceius writes of this place, evidently a little north of Cape Frio. "This land lies 18° S of the equinoctial line and 37° W of Lisbon as is demonstrated by our instruments."¹ From this place the squadron returned to Lisbon.

Vespuceius hoped to discover the place where spices grew—*ir a descubrir el nacimiento de la especeria*—a thing which neither Portuguese nor Spanish had yet done: spices loaded in India came from further east and south. From a letter to him about 3 years after his voyage and before he was appointed *piloto mayor* of Spain Vespuceius was in communication with the King and Queen of Spain in regard to a squadron which was to sail for this purpose. It never sailed apparently and there is nothing in the letter to indicate it was to go west—the way taken by Magellan. The squadron was ordered or to be ordered to go where the spices grew; to a point east of Calecut and Malacca; to the Molucca Islands in fact. Spanish ships could go there only westward without transgressing the Papal Bull.² Beside the voyages far south of Coelho and Vespuceius there was one by Christovao Jaques in 1503 and another in the following year by Gonneville a Frenchman;³ of these little is known though it cannot but be concluded they were failures. They were before Serrano and Magellan sailed from Malacca for the Moluccas when the thought of the great voyage to be made must first have arisen: quite 3 years before Columbus died; no wonder cosmographers and the maps they made did not put the lands and seas discovered in correct place.

EXPLORING SHIPS WERE AT OR NEAR THE STRAIT BEFORE MAGELLAN.

So soon as it began to be believed there was a continent where America is a conviction formed there must be a seaway through it and ships searched for this, ascending waters making into land sounding and

¹ Above p 340. This lat and long are about right: the former was found by meridian altitude of the sun with an astrolabe and the last by reckoning carried out from Lisbon.

² The letter is p 317 v 2 Nav Colec and date Sept 15, 1506. See Ravenstein Behaim and Globe p 37 as to early voy of Portuguese toward Cape Horn; also Descubridores del Estr de Magallanes Guerrero Vergara Santiago de Chile 1880, 2d part of this 1553-89 has been published but apparently no first part.

³ Fiske Disc America v 2 p 167 note.

trying water for saltness, and map-makers and cosmographers drew passages on their charts as well as other interesting and wonderful things. Antonio Galvano, born in Lisbon 1503 and resident long in the East where he must have known many pilots and cosmographers, wrote about 1557 35 years after the Victoria reached the Moluccas his Discoveries of the World in which he says, "In the year 355 before Christ it is said the Spaniards sailed through the main sea until they came unto the shores of India and Arabia x x sailing to the north-west x x."⁴ This of course is fable; no ship passed from Europe north of Asia and emerged through Behring's Strait until 1878-9 when Nordenskiöld made the passage in the Vega.⁵ Behring Strait was found 1728 by Vitus Behring a Dane in the service of Russia and Amundsen passed along the north coast of America in the Gjoa in 1903-7; then only were all outlying promontories laid down. Galvano narrates other tales which must be partly fables. He writes of, "A map of the world x x. The Strait of Magellan was called in it the Dragon's Tail: The Cape of Good Hope the Fore-front of Africa x x." This map belonged Galvano says to the oldest son of Don Peter King of Portugal 1428: he writes also, "In the year 1528 Don Fernando the King's son and heir did show a map x x which had been made 120 years before, which map did set forth the navigation to the East Indies with the Cape of Good Hope according as our later maps have described it."⁶ These tales cannot be dismissed as only falsities. Galvano was a man of long experience in the East where he was governor in the Molucca Islands and though we can hardly believe a ship won through along the north coast of Asia before the Christian Era nor that the Strait Magellan passed in 1520 could have been drawn on a map in 1400 the rest of what he says is not only possible but probable. The map of Marino Sanuto 1310 and Laurentian portolano 1351 both made in Europe show a sea route around the south of Africa.⁷ Arabian seamen found the land ended and represented this on maps and these had passed up the Red Sea and west in the Mediterranean. Maps showing coasts and islands east of Africa reached Europe 1500 years

⁴ Disc of World Hakl p 43.

⁵ Nordenskiöld, *Voy Vega*: the distance from Karlsrona is 5800 miles and the Vega was a year making the passage.

⁶ P 67: our author was 25 in 1528 and may mean this map made about 1400 was shown to him.

⁷ Above p 246.

before the birth of Galvano and that ships plied in these waters for 2000 years without seeing or suspecting a south cape is not likely.

But until Dias and Magellan passed the Capes in 1486 and 1520 knowledge regarding them was shadowy. Pigafetta accompanied Magellan, "For to see the marvels of the ocean;" he was one of the few who lived to complete the circum-navigation and wrote a history of the voyage:⁸ he was devoted to Magellan as his history shows and as to Magellan's previous knowledge of the Strait writes, "The captain-general knew where to sail to find a hidden strait which he saw depicted on a map in the treasury of the King of Portugal which was made by that excellent man Martin de Boemia."⁹ This is stated otherwise by Gomara who was 9 years old when Magellan sailed, "Ruy Faleiro," he wrote,¹ "Was a great cosmographer and Magellan a great sailor who affirmed that by the coast of Brazil and River Plate we could pass to the Spice Islands *much nearer* than by the Cape of Good Hope; at least before going to 70°,"² according to the sailing-chart the King had made by Martin of Bohemia, although that chart *showed no strait* as I have heard."

Both sides of S America were coasted before Magellan came. Vespuccius Coelho Jaques and others were on its east side as far as the extreme south of the continent; about 56° 250 miles south of the entrance of the Strait. There is no reason to suppose one entered the Strait or looked into it; though on maps dated 1515 and 1520 made by Schoner a strait is shown, as well as on the Lenox Globe of 1510,³ now in the New York Public Library. To show how imperfect information was it should be noted that Schoner shows also openings through the Isthmus of Darien. There is an important legend on a map made by Ruysch before Magellan sailed at the south end of a continent of irregular rectangular shape placed where South America is: it reads,⁴ "Portuguese mariners have examined this part of this country and have gone as far as the 50th degree of latitude without reaching its southern extremity." On the west side of Mundus Novus at its northern end is this; "Spanish

⁸ Voy Magel Hakl; Prem Voy Amoretti.

⁹ Mag Voy xx by Pigafetta Robertson v 1 p 65: see also Ravenstein Behaim and Globe pp 34-5.

¹ Hist Gen Indias chap 90: Faleiro was to have gone the voyage but did not: see Guillemard's Magellan pp 189-90 as to knowledge of the strait.

² The mouth of River Plate is 35°.

³ 120 v 2 Fiske Disc Amer: Schoner Globes in Guillemard's Magellan.

⁴ The map and this and other legends are p 114 v 2 Fiske. On this continent is written, Terra Sancte Crucis sive (or) Mundus Novus.

sailors (note the map-maker is right; Spanish sailors it was who visited this coast and Portuguese its south end) have come as far as here and they call this country a New World because of its magnitude, for in truth they have not seen it all nor up to the present have they gone beyond this point. Wherefore it is here left incomplete especially as we do not know in what direction it goes." This map was published Aug 13, 1508 and proves European seamen were exploring the Pacific before Balboa saw it in 1513. To complete the story of the Pacific; Cortez landed in Mexico 1519 and Pizarro in Peru 1524. Spanish seamen had crossed and gone south from Darien before Balboa crossed the Isthmus; Portuguese ships had been far south on the east coast before Magellan was; but there is no warrant for belief ships had rounded South America or seen the Strait. While much was done by others it was Magellan who found and passed the Strait; this and the courage which inspired him to cross the Pacific make him first among seamen.

Before leaving the map of Ruysch a legend away up north in latitude about 70° must be noted; it reads, "Here the ship's compass loses its property and no vessel with iron is able to get away." Whoever reported this had been so far north his compass was useless because of nearness of the magnetic pole. No one could have imagined such a thing: the second part of the legend was added to satisfy the craving for the wonderful, more common in former days than now. This is a different thing from writing in the sea in equatorial latitudes that the compass did not point as Martin Behaim and others did; yet of the last there is reasonable explanation as we have seen.⁵

THE LETTER MAXIMILIAN TRANSYLVANUS WROTE WHEN THE VICTORIA
RETURNED.

There are many documents in Navarrete's *Coleccion* which show the beliefs and views of Magellan and those of his day. Of these none surpasses in interest a letter written by Maximilian Transylvanus secretary at the court of the King. He was pupil of Peter Martyr whose *Orbe Nova* has been referred to, the natural son of a great prelate, and his wife was niece of Cristobal de Haro merchant who furnished money to fit Magellan's ships. The opportunities of Maximilian to learn the truth were of the best. The date of the letter is Oct 5, 1522 and it is

⁵ P 271 above.

in part as follows; ⁶ “A few days since arrived in Spain one of the 5 ships the Emperor sent x x to search for and discover the islands where the spices grow. x x We know for certain that some kinds of cinnamon cloves and mace are brought to the East Indies from very distant islands known by name only to the Indians at Malacca. These spices are brought from these remote islands in vessels called *juncos* which are made without nails, held together by pins of wood in place of nails. Their sails are square (*redonda*) and woven from palm leaves and they sail with one wind fair or contrary. ⁷ x x With much diligence I have informed myself of the truth of all from the captain of the ship who has just returned ⁸ and from seamen who were with him. The captain and sailors recounted to the Emperor and others all and each one of the things which happened in the voyage with great and sincere fidelity and it was clear to those who heard them they spoke the truth without mixture of anything fabulous. x x The Spanish navigated towards the south and turned towards the west and the Portuguese towards the east, passing many degrees beyond the Tropic of Capricorn discovering and finding many and new countries; finally our Spaniards who have just returned in this ship have taken a turn around the universal world x x. Thirty years ago ⁹ the Castilians began towards the west and the Portuguese towards the east to discover by command of their Kings with their fleets and armadas new and unknown lands, and as the Pope Alexander VI deemed the Kings might interfere with one another and have differences as to the lands they discovered he divided equally the navigation and conquest of all that might be found and discovered in the world x x drawing a line from pole to pole 100 leagues west of the Cape Verde Islands. All to the west of this line should belong to the King of Spain and all to the east to the King of Portugal. x x After great and unheard-of voyages made by the Portuguese there was a rumor and report though uncertain which said that so wide was their navigation eastward that they were extended into our hemisphere beyond the terminals of the above-said partition and line from pole to pole; and that the city of Malacca¹ and the great

⁶ Navar Colec v 4 pp 249-284.

⁷ The Spanish is *prospero ó contrario*; the monsoon.

⁸ Juan Sebastian del Cano; commanded the Victoria from the Moluccas around the Cape of Good Hope to Spain.

⁹ 1492.

¹ Captured for the Portuguese by Albuquerque 1511.

gulf of the sea of the Chinese² fall and are within the lands of the King of Castile. Yet no one could believe these things until some 4 years ago in the year 1518 there came and passed from Portugal to Spain a noble man (*noble varon*), a Portuguese named Hernando Magallaes who had been captain for the King D Manuel of Portugal and had sailed in his armadas and who knew and comprehended all the parts discovered in the east by the Portuguese. xx Fernando Magallaes captain and Cristobal de Haro merchant came to the court of our Emperor and King of Spain to say and make known and give proof that Malacca was within the limits of the King of Spain. Yet this could not be determined absolutely nor could it be beyond doubt because the certain means of finding the measure of longitude in the earth was not yet known. x x It was most certain however and without any fail that the Islands of the Moluccas where grow the spices are and fall in the western partition belonging to Castile and that from these islands come the spices traded in in the great city of Malacca. x x If His Majesty would send his ships and armadas, not by the eastern voyage the Portuguese make, but by the western seas descending to the other hemisphere, they could bring to Castile a large quantity of spices at much better prices than the Portuguese could do from Malacca or Calecut. This was heard by the Emperor and those of his Council. It seemed to him a difficult and vain thing x x because of the uncertainty of being able to pass and navigate yonder by the west. They believed that nature had perhaps closed and distinguished the eastern parts from the western so that it was impossible to pass from one to the other part. Or perhaps a great *tierra firme* was so perpetual and without end as to separate them x x so that it was impossible to pass or navigate to go that way from here to the east. x x But they both insisted desiring by themselves and their industry to discover the Moluccas; Hernando Magallaes offered to go in person and Cristobal de Haro to equip at his cost and that of his friends the ships that were necessary for the voyage. x x Five vessels were prepared for the voyage; Hernando Magallaes was made commander of them and was ordered to coast along and verify the *tierra firme* beyond where it was known and discovered, and that he should always proceed to the south towards the Austral parts until he saw if there was a cape and end of this *tierra firme* or until he found the great passage where he could navigate and

² The word is *Sinas*.

pass to the other sea of the south by which he could go in search of the Molucca Islands until he found them."

"When the preparation of the 5 ships was completed they sailed from Seville the 10th of August 1519 x x. From the Cape Verdes the voyage was towards the *tierra firme* of the Western Ocean sea towards the part between west and south. x x Following this course continually they arrived at the end of March 1520 at the gulf of S Julian. Considering carefully the degrees in which the gulf is situated, seeking by the declination of the sun—which our mariners used in these seas more than any other luminary after losing sight of that of the arctic pole—as well as the elevation of the antarctic pole, they found they were $49\frac{1}{2}^{\circ}$ on that side of the equinoctial line. And found also they were in 56° of longitude more west than the Canaries.³ x x As there were signs that here was a strait to pass to the other South Sea Captain Magallae ordered 2 vessels to enter and explore while remaining in the open sea with the other 3 anchored. The 2 vessels that had entered finding no passage returned in 2 days. x x Detained purely by the cold and bad weather they were almost 5 months in the bay of S Julian (it was winter) and in that time never saw on those coasts an Indian. The men besought Captain Magallae to return where the winter was not so severe x x for they were without hope of finding the end of the *tierra firme* or the passage to the other sea they were seeking; they were perishing of hunger and cold and the stores could not last much longer. Magallae heard the complaints and replied contradicting them saying he had in writing the orders of the Emperor x x. He would go on until he found the end of this land or how to pass to that other sea of the south x x. He would die rather than return with shame and ignominy to Spain."

Here follows about bad feeling in the fleet, but of the violence mutiny and executions at this point there is nothing.⁴ The letter con-

³ Probably latitude was by a large astrolabe onshore hung on a tripod. The latitude of the entrance of the Bay of St Julian is $49^{\circ} 15'$; the latitude stated is nearly right. The bay is large and we do not know at what point in it the observations were made. The longitude west from the furthest east of the Canary Islands is $54^{\circ} 10'$; from the west-most Canary it is $49^{\circ} 10'$. There can be no doubt the longitude is by dead-reckoning carried out from Spain; it is too close to be by observation. See pp 340 above and 590 below.

⁴ Probably because el Cano one of the mutineers was no doubt the principal narrator before the King; he was chosen captain of the Victoria after Magellan's death in the Philippines and came home in that capacity. It is curious that he received the honors. Magellan should have received and was trusted to go a second expedition.

tinues; "Captain Magallaes with his armada having been detained in this gulf of S Julian almost 5 months because of the great cold gales and winds of the winter which in these parts lasts from March until almost the end of August sailed Aug 24, 1520. Following his voyage he coasted the *tierra firme* towards the austral part of the antarctic pole making many tacks and returns ⁵ and searching for the passage he desired to find to the other sea of the south. Navigating thus for more than 2 months along these coasts they came to a cape and high promontory to which they gave the name Cape of Santa Cruz. And as they arrived at this cape there came a sudden tempest from the east; it took one of the 5 ships in the side and broke her; there was saved however those who were in her and her stores x x. Still following the coast with 4 ships the land turned between east and south and they arrived finally Nov 27, 1520 at some mouths and entrances made by the sea into the land showing signs of a strait. The captain ordered 3 ships to search diligently if there was a passage to the other sea of the south, he remaining with the other ship at the mouth of the Gulf x x."

The ship that foundered was the Santiago the smallest in the fleet. One of the ships sent into the gulf to explore was the Antonio. Upon her return Magellan's ship not being near the crew rose and mutinied, put the captain in irons and steered for Spain where they arrived in 8 months. Magellan had now 3 of the original 5 ships, Concepcion Victoria Trinidad. The Concepcion went as far as the Philippines where after the death of Magellan she was burned as leaky and unserviceable; her men being distributed between the Victoria and Trinidad. The letter continues; "Two of the ships sent to examine if there was a passage returned; but the other which was commanded by Captain Magallaes' nephew Alvaro Mezquita did not. The Captain-General waited some days, and as she did not return concluded one of two things; either that she had been lost and sunk or else the Spanish had risen against his nephew and carried the ship back to Spain; as had happened.⁶ One vessel reported she had found great signs indicating this was the strait and passage they were searching into the other sea of the south. x x The more they advanced the greater depth they found until they could get no bottom and because of the currents they found they were certain it was the strait by which

⁵ *Vueltas y reflexiones*: *vueltas* means tacks and *reflexion* return or reflection.

⁶ Barros says Magellan had his astrologer prophesy as to this.

they could pass to the south sea. Upon receiving this good news Captain Magallaes ordered the 3 ships to hoist all sail x x. Studying their sailing-charts they found they were 52° on that side of the equinoctial line and in the same longitude as the Gulf of S Julian which is 56° west of the Canaries.⁷ And as when they were navigating there it was the month of December there was not more than 5 hours of night in which time there is in our part of Spain 15 and 16 hours.⁸ They proceeded by the Strait and arrived at the South Sea in 22 days. x x Upon reaching the sea Magallaes seeing that the land turned towards the north x x directed his course between west and north by that spacious and unknown sea with the intention of steering that course until he turned to keep within the torrid zone and go in that way by the west to reach the East. He had proof and knew well the Molucca Islands of the spices where it was his intention to arrive were in the most remote parts of the East and not separated or distant far from the equinoctial line and held it certain that navigating this way through the west he would pass below this our hemisphere and arrive at the east where the Moluccas are. They navigated 40 days continuously through the great South Sea with good breezes nearly always fair in which they never saw land but sea and sky on all sides. And at the end of 40 days they reached the Tropic of Capricorn and discovered 2 little islands. They steered toward them and finding them sterile and uninhabited called them the Unfortunate Islands. They remained there 2 days because there were plenty of fish. Then they hoisted sail and having navigated an infinite space in the South Sea for 3 months and 20 days during which they went forward with good and fair winds being almost on the equinoctial line they came in sight of a large island which they afterwards learned was called Jubagana. Then studying their charts they made their measurements to see what degrees they had here;⁹ they found they were within the Torrid Zone in 11° on that side of the equinoctial and as well as they could gather they

⁷ Considering it is not stated exactly what point the ships had reached both lat and long may be right.

⁸ In lat 52° S in Dec the sun is $7\frac{1}{2}$ hours below the horizon and as the morning and evening twilight are each more than an hour 5 hours of darkness. There would be in Spain in Dec 15 hours from sunset to sunrise. The elapsed time must have been measured by sand-glasses running one hour or $\frac{1}{2}$ hour; the fleet carried *relojes de arena* sand-glasses; see above p 348.

⁹ *Hiciese sus dimensiones para ver los grados que alli habia*; which must mean they worked up the dead-reckoning for longitude. The references to charts imply one of what is now called the Pacific was onboard.

believed they were in degrees of longitude west from Cadiz.¹ Upon discovering the Island Jubagana they began to see many islands, it seemed as though they were in an archipelago like those in the Mediterranean. When they arrived at Jubagana they found it uninhabited; x x soon they saw another little island called Acacan where there were Indian vessels called *canoas* by the dwellers here and made of the great trunk of a tree and so small they could contain only one or two persons. x x They began to talk by signs with Indians here asking what these islands were called and where drinking water could be found for they were in great need to water afresh the 3 ships. They replied that the first island we had arrived at was called Jubagana and the one we were at now Acacan; the one and the other were un-peopled without dwellers but here in Acacan was good water. x x From here not far was the island of Selan; x x it was inhabited and there we would find everything necessary to sustain human life. Providing the ships with water at Acacan they sailed for Selan but being assailed by tempests of contrary winds fell by chance upon the island of Masana where dwelt a King of 3 islands. They soon passed on and came to another island called Subuth very large and broad. Making peace with the King of Subuth our people landed to celebrate the divine office of Easter-day of the Resurrection of Our Lord the year 1521. To celebrate the feast we took the ships' sails and gear onshore and cutting branches from the trees we made on the shore a holy chapel and in it an altar like those used in our Spain to celebrate mass. x x As Captain Hernando Magallaes considered the island of Subuth very rich in gold and that it had much ginger and that its situation territory and position was very convenient for exploring other islands near-by he spoke to the King of Subuth about turning Christian."

Magellan's relations with the King led him to go in boats with cannon and armed men with the King's men to a near by island called Mauthan and here Magellan was killed. The letter goes on; "Captain Magallaes had a slave who was a native of the Molucca Islands where grow the spices where finally was directed his principal voyage. He had bought him in the parts of Calicut in the city of Malacca when in the service of the King of Portugal and bringing him to Spain had taught

¹ As stated above this letter is in Navar Colec and the longitude is there blank as well; Navar says nothing of this. In Albo's Journal there is no blank longitude; see above p 335. A track chart of the voyage was made in Spain in the Deposito Hidrografico in 1812; Navar Colec v 4 p 27; and one is at p 142 Guillemard's Magellan.

him Spanish which he learned perfectly. By this slave Magallaes could talk to the King of Subuth, not because the slave understood the language of that country but because the King had an Indian who had lived in the Moluccas and understood their language well." There follows a sad tale. This slave was with Magellan when slain and being wounded took to his bed. Juan Serrano brother of Francisco Magellan's friend had been elected to command the ships after Magellan's death and gave orders to this slave threatening him with flogging. The slave therefore told the native Kings the Spaniards meant to despoil them and several Kings among others of Subuth and Mauthan who had formed alliance after the death of Magellan made a plot: Serrano and the Spanish were invited to feast with the Kings and 27 going to the entertainment they were set on by many natives and fled towards the ships, but these hoisted sail and left the harbor abandoning their comrades onshore.

The letter goes on: "Ours having in the way stated lost two captains Magallaes and Juan Serrano and 35 or 40 of the principal Spaniards at Subuth and Mauthan departed from there very sad and disconsolate;" they came to Bohol and removed the tackling supplies and armament of the Concepcion being too short-handed to work 3 ships and burned her hull. Going on they came to several islands whose people and customs are told of; at Gilona the inhabitants had ears so long they reached to their shoulders and as the Spaniards marvelled the natives told of an island near-by where people had ears so long and broad they covered their heads with them: "But as the intention of our Spaniards was to find the spices and not monstrous things" the letter continues, "They prosecuted their voyages directly to the Moluccas." The letter recounts, "Eight months had passed since Captain Hernando Magallaes was killed in the Island of Mauthan when ours discovered and arrived at the Moluccas in November of the year 1521: these are the principal source of the spices so greatly desired with wide navigation and toil and the death of Captains Magallaes and Juan Serrano and many companions while searching these strange seas with peril and many dangers. We found 5 isles whose names are Tarante Mutil Theodori Maithien Bandan, part are a little beyond the equinoctial and others on this side and all are small and not far from one another."

Here follows a description of the islands and how the spices grow are harvested and marketed: the cargoes go in junks to Malacca. In

Magellan's Voyage Hakluyt p 136 it is related the ships on loading the first cloves, "Fired their bombards for joy." Maximilian's letter continues; "Everything being finished for our Spaniards they hoisted sail and departed from the Island of Theodori to return to Spain; but they had left the port a little way only when the Trinidad the larger of the two vessels began to make water by openings the long voyage had made in such a manner that they did not dare to go on and both vessels returned to the port of Theodori to remedy this and calk her. xx It was finally agreed that the Victoria should proceed with the people in her and the Trinidad remain to be calked, and that the Victoria should not return by the way of the archipelago and Strait by which she had come but incline to the Cape of Catigara, and, found the Catigaran,² would engulf herself in the sea and leave aside as much as possible the coasts followed by the Portuguese voyagers in arriving in the ports of Calicut until they came to the cape and promontory of Africa called the Cape of Good Hope which is from the equinoctial line beyond the Tropic of Capricorn; before arriving at the Cape of Good Hope would be the great difficulty of the voyage for from there on they would go direct to Spain. The Trinidad should remain and prepare to depart, making her voyage not by the way the Victoria was to come but by the archipelago by which she had come and the strait of the tierra firme by which they had passed. This being agreed on as above between the 2 vessels they turned to part and hoist sail from the port of Theodori, the Victoria to go by the *eastern* way. This one sailed the month of November of the year 1521. Following her voyage she arrived at Cape Catigaran and found it 2° on that side of the equinoctial; having navigated great gulfs and seas she reached the Cape of Good Hope and still following her voyage she arrived at the Cape Verde Islands which belong to the King of Portugal. Here as the ship had become broken³ and leaking the men in her being worn out for want of things necessary for them and by the long voyage it was forced on them to touch at these islands. Thirteen Spaniards landed and having no money offered to pay for purchases with spices in the vessel as is the

² Though it did not exist Catigara had long life. It was placed by Marinus of Tyre and Ptolemy south and east of the Golden Chersonese called now Peninsula of Malacca; it was the furthest known east, distant 12 hours; see map of Ptolemy Bunbury's *Anc Geog* where it is south of what we call the Penin of Malacca.

³ This word is *destrozada*: it means destroyed broken in pieces. The statement coasts frequented by the Portuguese were to be avoided explains why the Victoria went far south and did not touch at the Cape.

custom of seamen. xx When the King of Portugal's governor learned the ship was loaded with spices xx he seized these men. The 18 men left in the ship for in the ship there came only 31, when they heard this xx hoisted sail leaving the 13 behind and followed the voyage to Spain. Ten months had passed since the ship left Theodori in the Moluccas when they arrived by so great risks and so many and great dangers at the port of the sea nearest to Seville on September 10, 1522. Certainly those 18 seamen brought by this ship to Seville are more worthy of perpetual memory than the Argonauts xx. This our ship should be placed and glorified among the stars xx. Having left Seville towards the south turning then to the west and passing under⁴ this our hemisphere this ship penetrated to the eastern parts; from which towards the west she circled the globe and orb of land and water returning to Seville whence she had set out."

The letter closes, "With all humility I commend myself to your Most Reverent Lordship. From Valladolid the fifth of October of 1522. Maximilianus Transilvanus Secretary to His Majesty." It was written by Maximilian to his father at Nuremburg.⁵

THE RETURN FROM THE MOLUCCAS.

It is not clear why the Victoria returned by the west by the Cape of Good Hope, though clear they feared the hostility of Portuguese ships that might be met. When the Victoria and Trinidad were to return they steered west from Theodori intending to round the Cape of Good Hope but the Trinidad springing leaks the 2 put back and the plan was changed; the Victoria would go west and Trinidad east through the islands they had passed coming out. "The Victoria would sail at once," another account reads,⁶ "To take advantage of the east wind which had already begun. The Trinidad would refit wait for the west wind and go to Darien which is on the other side of the sea in the country of Yucatan. xx Saturday the 21st of December the King came to the Victoria with 2 pilots we had already paid to conduct us out of these islands. They said the weather was good for sailing at once but having to wait for the letters of our companions who remained behind and who wished to write to Spain we could not sail until midday. Then the ships took leave of one another

⁴ The word is *yuso*: dictionaries say it is an old form for *debajo*, under.

⁵ See also for general description of the voyage Not Biografica v 4 pp XXV-XC Navar Colec; *Primer Viage al Maluco* pp 1-109 same v.

⁶ *Voy Magellan Hakl* pp 145-6. The monsoons among the islands are not the same as in the open sea; it was December and the monsoon was easterly.

by a mutual discharge of bombards. xx Juan Carvalho remained at Theodori with 53 of our men; we were 47 Europeans and 13 Indians. xx We took the south-west course."

The Victoria braved the Portuguese perhaps because her people had been that way before and it was deemed the better route: perhaps because it was desired to explore the Catigaran: by that way she would have the favoring S E trade to the Cape of Good Hope and beyond would be much at home. The Trinidad, old and leaky, did not dare to go in the west winds of high south latitude to Cape Horn; no ship was to go this way, a long and tempestuous one, until 250 years had passed; she would go north, not far enough to have strong west wind but enough to be out of the trade, and then east to Darien or Mexico, of which the whereabouts was known from the records of many ships; Cortez landed in Mexico the year Magellan sailed from Spain. The way was shorter, they were many of them familiar with it, and at Darien would be among friends. When Spanish ships trafficked regularly to the Far East they went this way; cargoes were unloaded in Mexico carried overland and re-shipped.

Thus the Victoria after Magellan's death took the way home around the world. It is said Columbus being in the West Indies and deeming he was near Asia thought of returning to Spain by the west ⁷ but I have been unable to find statement to this effect, though he had hopes of developing trade with the Grand Khan when his ship was on the coast of Darien.⁸ The notion of sailing around the world was very old and probably other explorers as well as Magellan and Columbus had dreamed of it.

The Victoria reached Spain, but the Trinidad after attempting to return across the Pacific east put back to the Moluccas and was seized by Portuguese who had come there on hearing there were Spanish ships within what they held to be their part of the world. It is an interesting situation; the Spanish ships alone, unseaworthy and with their men still alive hardly able to stand, surrounded by enemies and savage islanders. Their charts and ways were sufficient else they must have perished. Some in the Victoria were acquainted with the way she was to follow for it was nearly the one Portuguese ships had taken for 30 years, but no ship had been the way the crazy Trinidad took. She had crossed the Pacific from the Strait to the Philippines in latitudes near the equator with S E and N E trade winds and knew she must go north from the

⁷ Fiske Disc Amer v 1 p 475; Winsor Columbus p 295.

⁸ Harrisse Notes on Columbus p 95: Navar v 1 pp 299, 304.

Moluccas to about 30° when turning east in the first west wind that made she had the run from 140° east to 110° west longitude to make the peninsula we call Lower California; about 6000 miles. From the record we may conclude that though no European ship and probably no ship at-all had made the run the Trinidad knew what was before her.

The Victoria sighted Amsterdam Island 38° S and 3000 miles east of the Cape where as was to be expected she had west wind, dead foul;⁹ but she went south to avoid Portuguese ships. The Trinidad sailed when her repairs were completed April 1522 and steering north among the islands reached 42°. ¹ Here she was damaged in a gale and turning back reached the Moluccas six months after departure: more than half the men who had started home in her were dead and the living scarce able to stand or work the ship: ² ship and crew were seized by the Portuguese as in violation of the grant of the Pope.

There is account in Navarrete of the examination of Espinosa captain of the Trinidad held in 1527 at Valladolid after he was released by the Portuguese and allowed to return to Spain.³ Few have lived to tell such a tale as Espinosa: after recounting the sufferings of his crew and disasters to the ship he says the Portuguese came onboard, "With pilots and seamen and other armed men and seized by order of the said xx which they had with them all the charts astrolabes quadrants works on navigation and log-books in which had been written our courses the islands we had discovered and the produce of these" ⁴ xx. The circumstance shows the care with which ships' records were kept and how they were prized. The keenness with which men perceived and interpreted what they saw and diligence with which they recorded it is equalled only by their courage and fortitude in action. Any seaman of today would shake his head if asked to return from the Moluccas to California in a half-rotten ill-rigged craft like the Trinidad, but her crew did this without complaint as far as appearances go: they knew of the N Pacific Ocean only that it must be like the N Atlantic and no more of the land she would raise when across than that Cortez had landed in Mexico, that Balboa saw a great

⁹ Above p 335.

¹ Herrera, 3, 4, 2: as to Trinidad see Navar v 4, pp 98, 103, 295, 305, 378.

² See below p 600 n 4; also p 337 above.

³ Colec v 4 pp 378 and foll'g; particularly p 383.

⁴ The aids to navigation were carried to Portugal where the Portuguese historian Barros saw them; below p 590 n 7.

sheet of water from Darien 6 years before they sailed from Spain, that Spanish seamen had sailed on this sea 5 years before Balboa saw it, and that a governor sent from Spain to Darien 5 years before they sailed despatched ships to the north and south to survey and chart the land.⁵ Charts thus made may have reached Spain before Magellan sailed 1519.

FURTHER DATA ABOUT MAGELLAN'S VOYAGE.

Ruy Faleiro cosmographer and astronomer was to have sailed with Magellan but did not because a study of the stars made known to him the voyage would not be prosperous. His place as principal pilot and cosmographer was taken by, "Another astrologer Andres de San Martin a man learned in the science of astronomy."⁶ A work written by Faleiro by which, "Could be found the distance between 2 meridians which seamen commonly call *altura* east-west" was taken by Andres de San Martin on the voyage.⁷ San Martin said of this work, so Barros reports in this place, "The 4 chapters concerning conjunctions and oppositions of the moon and planets are reliable and certain; xx but the numbers in the almanach tables wrong as shown by attempts to find the distance between the meridian of Seville and their position by the oppositions of the planets and moon."

San Martin observed the conjunction of the moon and Jupiter Dec 17, 1519 at Rio; Feb 1 following he used the opposition of the moon and Venus; and 3 other attempts to find longitude by observation are recorded before the ships enter the Strait. After leaving the Strait opposition of the sun and moon was tried. "All these observations were calculated from the meridian of Seville," Barros writes, adding that the Tables of John of Monte Regio⁸ erred by as much as 42 minutes of time, six hundred miles.⁹ The longitudes were deemed valueless, this being shown by their difference from longitudes by dead-reckoning.

⁵ Navar v 3 p 393; Narr Andagoya Davila; Benzoni Hist New World: the last 2 are Hakl.

⁶ Barros Asia, 3, 5, 8. San Martin was a skilful pilot; p 307 v 3 Navar will be found, "The Royal Order to the Bishop of Fonseca to Inform Himself as to the Fitness of Andres de San Martin for the Office of Piloto Mayor Vacant by the Death of Juan Diaz Solis:" the date is Nov 16, 1516: perhaps the Bishop refused to pass him for he went with Magellan and was killed at his side in Mauthan from which it resulted that the *diario o derrotero* we have was written by Francisco Albo.

⁷ Barros, 3, 5, 10, as to Faleiro and long: the books of San Martin were in the Trinidad when the Ports seized her: above p 589.

⁸ Johann Muller, German astronomer lived 1486-76.

⁹ Herrera, 2, 4, 10: Guillemard's Magellan p 155; in Eng ed Herrera 6 vs 1727 this is v 2 p 177.

The King wrote orders dated May 8, 1519 to govern the fleet of which parts read as though Magellan may have written them; they are in part as follows,¹ “ The King Hernando de Magallanes and Ruy Falero Gentleman of the Order of Santiago: xx The principal thing that I charge and order is that in no way you touch or discover land or any other thing within the limits of the Most Serene King of Portugal my very dear and loved uncle and brother xx. Great care must be taken that when the ships are charged with supplies and other necessary things they are not overloaded as often happens xx; that the *manguera* ² shows above the water xx. Upon leaving the city of Seville or after leaving it thou shalt call the *capitanes pilotos* and *maestres* and give them the charts thou hast made to make this voyage and show them the first land which thou hopest to see for they should know by what *derrota* it is.³ Thou shalt order the capitanes of ships that each shall salute thee as is usual; xx this whether they are to windward or leeward each one as he can xx. At the time the ships give the salute the captain shall order the pilots to tell one another if the weather permits where they are as well the *alturas* as the *puntos* ⁴ xx and the *escribanos* (writers) shall record what each pilot says. xx Also thou shalt order the captains to watch with much care the other ships or the one carrying the *farol* (large lantern) and follow it always. When the ship carrying the *farol* wishes to know if the others see it she shall make a fire ⁵ and the others shall respond with other signals (*otros sendos*) so it may be known they are all there. xx When the ship carrying the *farol* wishes to tack or wear (*virar en otro borde*) she shall make 2 fires and all shall reply with 2 and after all have replied they shall tack. xx When a bonnet ⁶ is to be taken off 3 fires shall be made and they shall reply with 3 xx. To lower the sails (*amainar*) 4 fires shall be made and the others shall also make 4. If what God forbid any vessel should disappear she shall make many fires and all the other ships shall come to her aid. None shall tack or wear lower sails nor set nor reduce the bonnets without first the above signals are made, but if one vessel does not carry her sail as well as another and has to shorten sail she shall do this and then

¹ Navar v 4 pp 130-52: the blank following the word King occurs in Navar.

² Guillemard Magellan p 128 says the *manguera* was an opening in the ship's side provided with a flapper-valve by which pumps discharged bilge-water: the word is not in dictionaries. The opening was above the upper deck.

³ The course to it.

⁴ Latitudes by observation and position pricked on the chart; *punto*.

⁵ The word is *fuego*.

⁶ *Boneta*; a piece or sometimes 2 laced across the foot of fore- and main-sail.

signal. xx Thou shalt proceed to the land thou namest to the other captains and pilots and on arrival shall land and place a monument (*porneis un padron*) showing our arms and declaring the degrees of latitude as well as those of longitude in the demarcation between this Kingdom and that of Portugal."

Then follow rules about ships being separated, how long others are to wait for them and how to indicate where they may be found. The King's instructions go on, "When with good fortune thou arrivest at the land and islands where the spices are thou shalt make a treaty of peace with the King and Lord. xx On learning the price of the things grown thou shalt procure them at the best price xx and load the ships. xx Since thou hast said that in the parts whither thou goest to find the spices there are ships from many places xx thou must warn these that they may not come to treat in these parts without our license or our captains and governors will seize their ships and capture the crews." What follows regards proceeds of sales after the voyage and will not be given except parts showing the ratings and quality of persons: this reads, "A twentieth part of all shall be taken to redeem captives; a fifth of what remains for Us of which thou shalt have a fifth; of the residue three parts shall be made, two shall be for Us and the arming and one for the ship's-company xx. The *escribanos* shall verify everything. The third for the ship's-company shall be divided as follows: the principal captains shall have 20 parts; the other captains of ships 8 parts; the *cuadrilleros* thou has to distribute to guard the treasure 6 parts and moreover one and a half per person; the *escribanos* of the *cuadrilleria* shall have 4 parts and one and a half to each person. The *maestres* and *pilotos* shall have 4 parts; the *contra-maestres* 3; the *marineros* 2; the *grumetes* $1\frac{1}{2}$; the *pages* 1. The *despenseros* of the ships, *carpinteros calefates* and *tonneleros*, the same as the *marineros*; the *fisico cirujano* and *capellan* 3 parts; the *lombarderos* $2\frac{1}{2}$ the *condestable* 3 and the *sobresalientes* and your servants shall have a part and a half; the *alguacil* of the armada 3; and all the men as well *marineros grumetes* and *sobresalientes* who fire with *ballestas* shall have besides a half-part and those who fire with *espingardas* a part entire. And because We take two-thirds of all the property (*hacienda*) after We have a fifth We will give the weapons of the said people; for without this We could reasonably take only one-half."

By the time the *Victoria* reached Spain it would require many *escribanos* to unravel these stipulations. At her return she had 31 men onboard,

all that performed the voyage out of nearly 300 who sailed 3 years before. As respects present meaning of the names of ratings above a list is subjoined; it is not likely the office of the ratings differed greatly at the time of the voyage;

Escribano—notary public.

Cuadrillero—leader of small band of armed men.

Maestre—controller of administrative part of ship, of supplies.

Piloto—pilot.

Contramaestre—sea-officer who commands crew and works the ship.

Condestable—constable.

Sobresaliente—officer commanding small body of men ready always.

Marinero—able seaman.

Grumete—seaman inferior to marinero.

Despensero—steward.

Carpintero—carpenter.

Calefate—calker.

Fisico—physician.

Cirujano—surgeon.

Capellan—chaplain.

Lombardero—handler of heavy ship-guns.

Ballesta—hand cross-bow.

Espingarda—small piece of ordnance, some pivoted on rail some worked by one or more men.

The *lombardas* were guns of large bore so-called because made first in Lombardy. The *ballestas* were man-carried cross-bows, not yet driven out by man-carried fire-arms; *espingardas* were fire-arms, in ships often on mounts pivoted on the rail, probably recoilless. The *lombardas* were allowed to recoil else they would have racked the ships greatly.⁷

The King's instructions continue; "And greatly we charge you to be vigilant and careful about lights for they are very dangerous at sea: above all the cargo carried by other officers of the ship shall be every night examined by you and he who has the watch and he shall pass the word

⁷ Guillemard's Magellan p 210 is a picture of the deck of Magellan's ship. The gun on a wheel-carriage like a field-carriage on the ship's port side is probably meant for a lombarda; on the ship's starboard rail is shown an espingarda; the last was probably breech-loading. The great bird the *ruk* off the ship's starboard bow flying away with an elephant in his talons is excusable; see Cordier's Yule's Marco Polo v 2 p 415.

to those succeeding him and the others. No-one shall go in a ship with a candle unless it is necessary and then the candle shall be in a lantern. xx All the supplies expended shall be noted xx and the people shall have their ration of food; they shall not be obliged to eat together as in other voyages from the west to east is the custom but in *cuadrillas* as in the ships which go from Portugal to India issuing the ration every 2 days.⁸ Each shall have his honest ration, the biscuit by weight and wine by measure from the beginning of the voyage. If the voyage should be longer than expected the account of what is expended shall be made xx and if it is necessary to diminish the ration it shall be diminished. xx I charge and command you to forbid playing with cards or dice in the ships xx and give you power over all persons in the armada; if they do not obey your commands you may punish at your will⁹ as seems best to you. xx If by chance what God forbid any officer among those ordered to go in the armada should die in that case I give power to you the captains to elect another in place of him. xx If you should meet any ships of Portugal within our limits quietly require them in our name to leave the land for in the stipulations of our very dear and beloved uncle and brother this is forbidden." The instructions close with a list of the *quintaladas*, free freight-space allowed each man.¹

The only remaining document necessary to refer to is written by Magellan to the King and dated September 1519 just before the fleet sailed: it is in part as follows;² "Most Powerful Lord. Since it may be the King of Portugal at some time may say the Molucca Islands are within his Demarkation and may ask to have sent him the course of the coasts and may shorten the gulfs in the sea³ xx I have deemed it for the service of your Majesty to leave a declaration of the *alturas* of the lands and principal capes and the *alturas* in which they are in latitude as in longitude: thus will Your Majesty in case of the death of the undersigned know the truth."

⁸ A *cuadrilla* must be what is now called in ships a mess-crew. It is likely men in each prepared their own food; perhaps cooked it.

⁹ The word is *albedrio*; it means at will, governed by caprice rather than reason. It has been said Magellan had no right to execute mutineers as he did do; but here it would seem is the authority of the King.

¹ Guillemard Magellan p 147 says the 2 watches from midnight on were called *medora* and *diane* but I do not know where the authority for this may be found.

² Navar v 4 p 188.

³ Shortening the gulfs would bring the reckoned position of the Moluccas west: the words *derrotas de las costas* are trans courses of the coast; we say now trend of the coasts.

"The Island of San Anton one of the Cape Verde Islands on the coast of Guinea where is the Partition of the Kingdom with that of Portugal,⁴ this island is 22° to the east of the Line of Partition. The west point of this isle is in 17° latitude."⁵ [Anton is $25^{\circ} 19'$ W of Greenwich; he places the Line of Demarkation $25^{\circ} 19'$ plus 22° or $47^{\circ} 19'$ W. The latitude of the N W point of Anton is correctly $17^{\circ} 12' N$.]

"Cape San Augustin which is in the land of Brazil in the Demarkation of Portugal is in 8° of latitude and 20° of longitude from the Line of Repartition." [Cape San Augustin still so-called is almost the east-most point in Brazil: it is correctly $8^{\circ} 21' S$ and $34^{\circ} 57' W$ of Greenwich: this is $12^{\circ} 22' E$ of the Line of Partition as just defined by Magellan not 20° .]

"Cape Santa Maria which is in the same land of Brazil of Portugal is in 35° of latitude and $6\frac{1}{4}^{\circ}$ of longitude from the said isle." [There is now no cape of this name in this place; from old maps it follows it was where Maldonado is. The position of Maldonado harbor is $34^{\circ} 53' S$ and $55^{\circ} 00' W$ of Greenwich: it is thus $7^{\circ} 41' W$ of the Line. Magellan has $6\frac{1}{4}^{\circ}$ of longitude from the said *isle*; but must mean from the Line.]

"The Cape of Good Hope is with Cape Sta Maria east-west and the Cape of Good Hope is in 35° of latitude and 65° longitude to the east of the Line." [What we call the Cape of Good Hope is $34^{\circ} 22' S$ and $18^{\circ} 30' E$ of Greenwich; the last is $65^{\circ} 49' E$ of the Line. The extreme south end of Africa, which we call Cape Agulhas, was sometimes called the Cape of Good Hope: its position is $34^{\circ} 49' S$ and $20^{\circ} 07' E$ from Greenwich: if Magellan refers to this his latitude becomes more nearly correct and longitude more wrong.]

"The said Cape of Good Hope is *en derrota* E N E and W S W with Malacca and it is 1600 leagues to the port of Malacca." [The course is about correct for the direct line between the Cape of Good Hope and Malacca, and would thus appear on charts. Not till some years later than Magellan's day did ships make this run direct; they followed the coast of Africa north and east and then steered nearly east with the monsoon to Calecut or the entrance of the Strait of Malacca, by which route the distance from the Cape to Malacca is 6200 miles, or taking the league at 4 miles 1550 leagues.]

⁴ The writer did not mean this, as will presently appear: the Partition was further west.

⁵ Here and in places following I have included remarks on the accuracy of positions putting these between square brackets.

"The said port of Malacca is to the north of the equinoctial 1° and has from the other Line of Demarkation which is to the east $17\frac{1}{2}^{\circ}$." [The latitude of Malacca fort is $2^{\circ} 11' N$; its longitude $102^{\circ} 15' E$ from Greenwich: this is $149^{\circ} 34' E$ from the Line in the Atlantic, $30^{\circ} 26' W$ from that in the Pacific; not $17\frac{1}{2}^{\circ}$ as Magellan says.]

"The Islands of Molucca are 5 it is convenient to remember; the 3 that are nearest to the Second Line of Demarkation are all North-South at $21\frac{1}{2}^{\circ}$ of longitude and the middle island is below the equator. The other 2 islands are in the manner of the 2 first North-South and 4° to the east of the Second Line. It is convenient to remember, 2 north of the equinoctial and 2 south of the equinoctial, as agreed by the Portuguese pilots who discovered them." [These latitudes are about right.]

FOLLOWING MAGELLAN ARE THE MOLUCCAS IN THE DEMARKATION
OF SPAIN OR PORTUGAL.

Magellan believed Portuguese ships had gone east until they crossed the Second Line the Line in the Pacific, 180° from the Line in the Atlantic, and that the Moluccas were Spain's. He had been to the islands or nearly to them going east and must have passed many hours over logs of ships out and home, changing thousands of hourly or half-day courses and distances into distances north and south and east and west; adding the last to find longitude from Portugal to the Moluccas. The islands are correctly from $1^{\circ} 08' N$ to $0^{\circ} 13' S$, a line through them is nearly north and south, and their longitudes from $126^{\circ} 12'$ to $128^{\circ} 22' E$ from Greenwich. The middle point between these is $127^{\circ} 20' E$ and this we may take to examine Magellan's longitudes. If we accept his statement that the Line of Demarkation in the Atlantic was $22^{\circ} W$ from San Anton Island, it follows since the Line in the Pacific was 180° away and the Line in the Atlantic $25^{\circ} 19'$ plus 22° , $47^{\circ} 19'$, west from Greenwich, that the Line in the Pacific was 180° less $47^{\circ} 19'$, $132^{\circ} 41'$, E from Greenwich. As the average longitude of the islands is $127^{\circ} 20' E$ from Greenwich this point is $5^{\circ} 21'$ west of the Line in the Pacific; short of it for a ship going east. The islands are by this amount within Portugal's half of the earth. Magellan says 2 of the Moluccas are, "Four degrees to the east of the Second Line," and the other 3 $21\frac{1}{2}^{\circ}$ from it, but does not say on which side these 3 are. As Magellan says 2 islands are 4° east of the Second Line while in fact they are $5\frac{1}{3}^{\circ}$ west of it his error is $9\frac{1}{3}^{\circ}$, about 560 miles.

The error is in the reckoning of ships sailing between the Moluccas and Portugal by the Cape of Good Hope; it is $3\frac{1}{2}$ per cent. of the distance.

OTHER LONGITUDES AT SOMEWHAT LATER DATE.

Herrera a Spaniard published maps in about 1620 which show longitudes all the way around the earth.⁶ The date is 100 years after Magellan's voyage and the voyages *west* to the Moluccas during this period from New Spain or Mexico and by the Strait of Magellan had been collated and compared with voyages *east* to the islands. Thus Herrera shows the betterments in longitudes in the day Magellan-to-Herrera; 1519 to 1620 say. Portugal and her possessions were seized by Spain in 1580, 40 years before Herrera wrote, and since as the title of his work shows he was Royal Historian he had access to log-books of all ships which had sailed in the service of Portugal and Spain. In Herrera's day ships could not find longitude by observation, chronometers were 150 years away, and it was not the practice in Spanish and Portuguese ships to measure speed by the length of line reeled off in a time measured by a sand-glass.

Herrera measures longitude west but does not say from where, though it must be Cadiz or Seville. This difficulty may be avoided by not measuring from either. As already stated the Moluccas are $127^{\circ} 20'$ E from Greenwich, $232^{\circ} 40'$ W. The N W corner of S Anton Island is $25^{\circ} 19'$ W of Greenwich and thus the Moluccas are $232^{\circ} 40'$ less $25^{\circ} 19'$, or $206^{\circ} 21'$ W from that point: on Herrera's map they are 175° to 178° W from it, an error of about 30° and an important one since it places the islands 2° to 5° within what had been Spain's half before that country and Portugal were one. There is no means to know whether this erroneous position is the view of Magellan, but he certainly deemed the islands Spain's, and almost certainly by a narrow belt. If we accept facts as they are ships, many of them going east and going west for 100 years, brought in their records and the Royal Historian places the islands wrong in longitude from Spain by $\frac{1}{6}$, $16\frac{2}{3}$ per cent. It is known that in estimating a numerical value many times if the estimators are candid and

⁶ The maps from which the longitudes and latitudes about to be stated are taken are in Herrera's work published in Amsterdam in French 1622 3 years before his death under title Desc Indes Occid; the maps are at pp 2 and 76. There are also eds of Herrera in Spanish; upon the maps, which are the same in Fr and Span eds, the legends are in Spanish.

some steady cause does not mislead them the average comes nearly right; and the larger part of the above error may be charged to prejudices of the seamen and cosmographers whose conclusions the Royal Historian used.

The longitudes of other places on Herrera's map are interesting: Santiago in Cuba is $20^{\circ} 20'$ N and 56° W from S Anton; it is correctly $19^{\circ} 58'$ and $50^{\circ} 41'$ from it: Barbadoes Island is $11^{\circ} 40'$ N and $36^{\circ} 40'$ W, being correctly $13^{\circ} 03'$ and $34^{\circ} 18'$: S Ysabel Island, one of the Solomon group, is 5° to 7° S and 140° to 145° W from S. Anton, it is correctly $7\frac{1}{4}^{\circ}$ to $8\frac{1}{2}^{\circ}$ and 175° . It is safe to say the latitudes on Herrera's map were determined by huge astrolabes hung on tripods or other support and longitudes by reckonings of ships; though before their date we have record of a very few measurements of longitude by observation by direction of the King.⁷

THE DIVISION OF THE EARTH BETWEEN SPAIN AND PORTUGAL:

CONGRESS OF BADAJOZ.

If the Line in the Atlantic was 22° west of S Anton as Magellan says was the case the Moluccas belonged to Portugal; the reckonings of the ships on which he and Serrano and their friends relied had erroneously thrown the Islands east across the other Line into Spain's dominion. The Line in the Atlantic was drawn in the place Magellan says according to the Treaty of Tordesillas concluded between Spain and Portugal June 1494⁸ which states it shall be 370 leagues west of the Cape Verdes but does not say how many degrees this is nor from which one of the Cape Verdes the measurement shall be taken. It is Magellan and Spanish cosmographers who place the Line 22° west from S Anton the west-most of the Cape Verdes.⁹

Further examination leads to difficulty in determining the length of a league and mile. In the latitude of the Cape Verdes the length of a degree east and west is by modern tables 57.38 geographical miles. As Magellan makes the 370 leagues of the Treaty of Tordesillas into 22° of

⁷ Below p 627. See also below pp 666-67 for Dampier's longitudes in the Far East at a period after Herrera's.

⁸ Below p 600.

⁹ From p 345 v 4 Navar it results the Portuguese presented at the Junta at Badajoz a globe on which the Line was $21\frac{1}{2}^{\circ}$ W of S Anton; this would throw the line in the Pacific $\frac{1}{2}^{\circ}$ east; see p 603 n 2 below as to this.

longitude and 22 multiplied by 57.38 is 1262.36 he makes 1262.36 miles the same as 370 leagues; makes a league 3.41 miles and a degree of longitude at the Cape Verdes 16.81 leagues. Perhaps Magellan made a mistake. Lengthening the league throws the Lines in Atlantic and Pacific west; the one in the Pacific enough perhaps to carry it west across the Moluccas and leave them Spain's. In Columbus' day Spanish seamen reckoned a league 4 miles.¹ This makes 370 leagues 1480 miles, which in the latitude of the Cape Verdes makes $25^{\circ} 48'$ in longitude: this leaves the islands still in Portuguese domains but less than 2° on their side of the Line. There is one more loose point: the Treaty does not say from where in the Cape Verdes measurement shall be taken: the breadth of the group is $2^{\circ} 30'$ and if we measure from a point east of S Anton the Line moves east in Atlantic and Pacific, a change against the Spanish. It was from the east-most of the Cape Verdes the Portuguese experts at Badajoz wished to measure, notwithstanding this excluded their nation from the Cape Verde Islands and Brazil in both which they had a lucrative trade.

In the *Parecer de los Astronomos y Pilotes Espanoles de la Junta de Badajoz* 1524; that is the View of the Spanish Astronomers and Pilots at the Congress of Badajoz in 1524, we have authoritative statements of a few years after the Victoria returned to Spain: this reads,² "The Moluccas are not in the longitude the deputies of the Senor King of Portugal say but where we have said and shown by our *carta de marear*; so we say they fall and are distant 150° counted from the Line of Partition by way of the west as our process has shown. From this it results that from the said Line to the Moluccas it is by the way of the east 210° ." The *Parecer* was signed by Don Hernando Colon, Fr Thomas Duran, El Doctor Zelaya, Pedro Ruiz de Villegas, El Maestro Alcaez, Juan Sebastian del Cano: from the last name we may conclude the 150° west from the Line in the Atlantic to the Islands was from the run of Magellan's fleet. No-one can care much for del Cano, who was one of the mutineers, but all must regret the result is not nearer right: the calculation covers the months the ships were sailing west halfway around the globe and from 40° N latitude to 55° S and northward again to 20° N; it is wrong by 25° , 1500 miles or $\frac{1}{7}$.

¹ Jour Hakluyt in several places: see also First Voy Gama Hakl p 245.

² Hist Juan Sebastian Del Cano Navarrete Vitoria 1872: see again below pp 602-5.

SPANISH TRADE WESTWARD TO THE FAR EAST.

Spain claimed the Moluccas because of Magellan's discovery and seems never to have abandoned this.³ A Portuguese squadron arrived in the Islands soon after the *Trinidad* sailed for New Spain and remained until she returned, when seizing ship and cargo they treated the wretched captives with great brutality;⁴ but we read nothing further as regards Portuguese interference and a regular traffic grew up by way of New Spain to the old country; it never went, as did Portuguese trade and later that of England Holland and France, by the Cape of Good Hope.

THE PAPAL BULLS AND TREATY OF TORDESILLAS.

Pope Alexander VI issued a Bull shortly after Columbus' return from the West Indies it being intended to keep Spain and Portugal from quarrelling in newly discovered lands, and modifications were made September 1493 and June 1494.⁵ In the last it is provided the Line of Partition shall be, "A limit or straight line from pole to pole from the arctic pole to the antarctic which is from the north to the south which limit or line or sign shall be at 370 leagues from the Cape Verde Islands towards the west by degrees or other manner as may best and most quickly be established. xx From there the King of Portugal and his ships shall find and discover lands towards the east xx; these shall belong to the King of Portugal and his successors forever. All the rest as well Islands as tierra firme xx discovered and to be discovered towards the west and to the north and south of it shall belong to the said King and Queen of Castile Leon etc and to their successors forever."⁶ After Magellan's voyage came an Agreement between the Emperor and King of Portugal as to the Limits and Ownership of the Moluccas dated Jan 25, 1524 which recites that as there is doubt and debate as to which kingdom owns the Moluccas the question will be placed before astronomers pilots and seamen for

³ The cargo brought by the *Victoria* to Spain is listed p 247 v 4 Navar: its sale yielded about \$30000 which more than paid costs.

⁴ Navar v 4 p 311: Antonio de Brito the Portuguese commander wrote the King, "I wrote the Captain-General in India it would be more for the service of Your Majesty to order their heads struck off than to send them there. I have kept them in the Moluccas as the climate is sickly so that they may die there."

⁵ The first is called Extension of the Apostolic Donation of the Indies the second Argument as to Partition of the Ocean Sea Executed by the Kings of Spain and Portugal: see pp 404, 130 v 2 Navar. The last is the Treaty of Tordesillas: see also p 598 above.

⁶ Pp 136-7 v 2 Nav.

determination. Then follow Letters of the Emperor to Deputies Named to Treat at the Junta de Badajoz as to the Ownership of the Moluccas dated March 8, 1524.⁷ The names of some to whom these are addressed are familiar; Hernando Columbus son of the great discoverer and Juan Sebastian del Cano captain of the *Victoria* when she returned to Spain. The Emperor and King the Agreement states are, "Each to appoint 3 astrologers 3 pilots and 3 seamen who shall meet and join together upon the limit between Castile and Portugal, between the City of Badajoz and City of Yelbes." In April 1529 Spain sold her rights in the islands to Portugal⁸ but so far as appears her ships continued to trade there and when Spain seized Portugal and her colonies in 1580 the interests of the 2 countries were merged and the empire claimed by Spain covered nearly the whole earth.

THE INABILITY TO DETERMINE LONGITUDE.

There are curious circumstances which grew from the dispute about limits of ownership, and while we know—as indeed men of the former time knew—that longitude could not be determined; that any determination offered could be contested; the story is worth reviewing. There were no accurate time-keepers no submarine telegraph cables and no tables to show the position of stars and moon years in advance, and thus an arc of longitude between 2 places could be ascertained only by measuring on the earth between them. At the root of the difficulty lies the want of precision in the measure of length: no-one could tell the length of the 370 leagues prescribed in the Treaty of Tordesillas; and so it would be today excepting that our measure of uncertainty would be less wide than when the Junta sat at Badajoz. The accuracy written of in books is not found in the affairs of the world.

Gomara born 1510 and co-temporary with the Junta at Badajoz says of it,⁹ "There were present pilots makers of sea-charts globes maps and instruments necessary for the determination of the situation of the Moluccas; they obstinately argued most terribly (*Porfiado terribilissima-mente*); the Spanish wished to reckon from the most western and the Portuguese from the most eastern of Cape Verde Islands xx." In the Records of the Possession and Ownership of the Moluccas we read,¹ "On

⁷ Navar v 4 pp 320, 326.

⁸ Navar v 4 pp 389-406.

⁹ Hist Gen Indias Chap 99.

¹ Philippine Islands Blair and Robertson v 1 pp 165-221. This work consists for the most part of original records being in 55 vs.

the bridge over the river Caya² xx. They sent for the sea-charts and globes of each side which each desired. Several examinations were made. xx By common consent both sides presented globes showing the whole world, where each nation had placed the distances to suit themselves. The measurements were taken and the secretaries ordered to set them down. The measurements followed in the afternoon. Numberless differences were found; such that the globe of the Portuguese deputies showed 137° of longitude from the meridian of the Islands of La Sal and Buenavista to the meridian passage through the Moluccas where that of the Castilians showed 183°:³ both were measured eastward with a difference at 46°. xx The judges of Portugal presented the following notification: that because of the differences in the globes they believed it necessary to investigate and make certain of the longitudes in question; and for this they propose 4 methods.”⁴ The views of Hernando Columbus are stated as follows,⁵ “It is difficult and unsatisfactory to determine the size of the earth by measuring it by travelling or sailing and the same was maintained by Ptolemæus and other erudite men by actual test:” there was however no other way. The King directed the Junta,⁶ “In order that you may be better informed you shall always listen to the opinions and arguments of the astrologers and pilots.”

The most interesting of the documents is the Opinion of the Spanish Astronomers and Pilots of the Junta of Badajoz upon the Demarkation and Ownership of the Moluccas.⁷ It is too long to reproduce, is very involved, and contains many statements of latitude longitude courses and linear measurements. To those of our day an extraordinary feature are the references to Ptolemy Pliny and King Solomon and the Phenician

² The Caya flowed between Spain and Portugal; Badajoz was at one end and Elvez at the other: the Junta met in the cities on alternate days, the first time on the bridge.

³ The difference of longitude is correctly 149° 56'.

⁴ The 4 are stated: the statements are very involved and though the best of the day were not sufficient.

⁵ P 202 v 1 Blair and Robertson cited note 4th above; also pp 342, 355 v 4 Navar. In the last work at this place is the journal of the Junta and pp 369-70 appear a number of signatures among which is that of Espinosa who commanded the Trinidad when she essayed to come home eastward from the Moluccas. He signed with a cross so probably could not write; there are 18 signatures of men who had started with Magellan, of which 11 are by crosses. Among the 7 who signed their names are *maestres* and *contramaestres*, seamen of upper ratings. The ages of signers are given: only 3 in the 18 were more than 35 when the ships sailed from Spain; these were 40, 43, 45; Espinosa was 40.

⁶ P 215 v 4 Navar.

⁷ Colec v 4 pp 343-55: see p 599 above,

ships he sent down the Red Sea to India 2500 years before the time of the Junta. Yet parts of the Opinion help to make clear the ways of the age: of these some are;—

(1) The confusion of standards; the length of a mile league degree was unsettled. Charts made by different persons, and there were few or no duplicates, disagreed.

(2) The Spanish brought into the Junta a *poma rumbada*—globe with compass courses marked on it—on which the Line was drawn $21\frac{1}{2}^{\circ}$ west of San Antonio. The directions on this were in colors, black green red. It will not be forgotten Magellan wrote the Line was 22° west of this island.

(3) P 347. The reports of navigators running back some of them 100 years before the day of the Junta as to distances they sailed down the coast of Africa and on towards India; these begin at the Canaries and end in India; and this closes with these words, “Thus it is with reason that the *Itinerario Portugalsium* changed by Archangelo Madrignano from Portuguese into Latin which was printed 1508 in chapter 20 counts 3800 leagues from Lisbon to Calecut, that is to say 15200 miles: from Calecut to Zamotra the last chapter says it is 3 months’ sail.” As 15200 is 4 times 3800 a league is here taken at 4 miles: it is a Portuguese who says so: the line around promontories from Lisbon to Calecut is 11000 miles long and a ship could hardly log less than 15200 in covering this. The 3 months’ sail from Calecut to Sumatra is a gross error; the distance is 1500 miles to the north point of the island. As we have seen Portuguese ships had by this time made the run from India to St Helena, 8000 miles in a direct line, in 109 days; ⁸ nearly 75 miles made good per day.

(4) P 347. Here are reports of ships’-runs by Ginoves, who went to India and Malacca by way of Alexandria in 1494. He said it is 1400 leagues from Aden to Sumatra which is much too great: “This agrees,” the pilots who wrote the Opinion go on, “With Marco Polo and John of Mandeville xx and with what we read in The Third Book of Kings of the fleets sent east from the Red Sea by King Solomon which were 3 years going and coming from the eastern parts of *Ofir* and *Zetin* ⁹ and which brought gold to build the Temple xx. From all this we must infer that the navigation from the said Red Sea to the east of India is much longer than the Portuguese state publicly.”

⁸ Above p 567.

⁹ Above pp 34 and foll’g: Ofir is Ophir, Zetin China, perhaps its great port Zaiton.

(5) P 349. The Opinion says, " We called into our presence pilots and men skilled as well in the rules for navigating as in making charts spheres and world-maps. These continually and with great diligence have been able to procure information of the distances and courses (*distancias e derrotas*) upon this route, as well from persons who have navigated there as from those who have placed and painted the lands. Being sworn before 2 notaries and our secretary they say they know the said navigation and situation of the land is at much greater distance of degrees than that said by the deputies of the Senor King of Portugal xx who have now cut anew from the said route more than 25° of longitude from what until now they have published."

(6) Pp 349-51. Some latitudes and longitudes are given ending, " Malacca for the reasons stated and by the Portuguese charts is without doubt more than 161° distant towards the east from the Island of San Antonio. From Malacca to the Molucca Islands there is more than 23° of Longitude.¹ Thus the Moluccas are 184° east of San Antonio, to which must be added the degrees from the said island in the 370 leagues to the Line of Demarcacion."

(7) P 352. Here we reach the difficulty of measuring a distance and unless this was correct cosmographers and pilots could not agree. Even the lengths of the metal rods in modern day kept at constant temperature under glass, touched rarely and never by hands, differ. We read, " The Portuguese to include a greater quantity of land in a less number of degrees xx have divided their charts in the proportion of 70 miles to a degree or $17\frac{1}{2}$ leagues to a degree, which leagues have each 4 miles as is shown by the scales of miles on all their charts; by this means they include much land in few degrees. xx The miles are larger than those used by Ptolemy which have 8 *stadia* to the mile, for true and sensible it is that a sea-mile is longer and contains more than 8 stadia; for a stadium is the distance a man can run without losing breath commonly reckoned 125 paces:" it continues as to what Pliny wrote about Greek runners. Measuring by runners is very old and has been much descanted on. When the circumference of the earth is divided into 360° and each degree contains at the equator 60 miles, the length of a mile comes to be determined by the size of the earth and not by ways the ancients employed. The Romans placed stones along roads at each 8th stadium, each 8th distance a man could

¹ The dif long first stated is correctly $127^{\circ} 34'$ the second $24^{\circ} 45'$.

run without losing breath. Linear measurements established usually first by lengths of parts of the human body have in recent days been fixed by metal rods carefully stored and used.

Gomara says² a little boy clothed only in a shirt was washing clothes with his mother on the banks of the Caya while the Junta was holding deliberation on the bridge; turning his back to the Judges raising his shirt and bending over he called to them—you will never make as fair a division as that. Peter Martyr wrote while the Junta was sitting, "The Spanish wished the line of 370 leagues to begin at the most eastwardly island xx called San Antonio xx, the Portuguese insist it should begin at the island called Sel xx:" a little later he writes, "Each faculty had its representatives that is to say there are 6 astronomers 6 cosmographers and 6 sailors. You know only a few of these and His Holiness knows none. They have all returned. Nothing more was accomplished than I have mentioned. The verdict defined that the Moluccas are situated according to ancient and contemporary opinion more than 20° inside the limits assigned to Spain. The same holds good of Malacca and Taprobane; that is if the latter corresponds with the island the Portuguese called Zamatra xx."³ What Martyr says is wrong; the Line in the Pacific was east of the Moluccas making them Portuguese.

THE OCEANOGRAPHY OF THE WORLD.

Though the Greeks used a word oceanography and though it stands for the science which is the foundation of geography it is rarely used in speech and is not found in all English dictionaries. By it the ancients drew Europe and the world they knew; in about 800 A D and later the science was extended; Columbus was the principal figure in its greatest extension and Dias and Da Gama; and Magellan when he rounded the earth completed its broadest features. In 60 years following the Spanish and Portuguese staked out the great promontories and learned how to use the ocean-currents and wind-courses. The Portuguese went to the East by the Cape of Good Hope the Spanish by crossing or rounding America and the activity of both is marvellous. Ships and their rig and sails grew better fast while knowledge of how it was best to go accumu-

² Chap 99 Hist Indias.

³ Orbe Nova trans MacNutt v 2 pp 236, 240. The second letter was for the Pope. Martyr though born in Italy was practically a Spaniard.

lated rapidly, but those who went long voyages were for many years subjected to great risks and frightful was their suffering and mortality.

Dias laid down the first great precept of oceanography when about 1486 he showed how to go from Europe to the East in the N E and S E trade winds. The trade winds had long been known and Marco Polo before 1300 told of the monsoons of the coast of Asia, used in days immemorial by ships there. Juan Fernandez a Spanish pilot about 1560 showed how a sailing-ship should go south on the west coast of S America, thus completing the outlines of the science. The wind here blows from the south the year round; for reason easily seen when it is recollected the chain of the Andes is close to the sea. The plan found and used by Juan Fernandez is still used: ships bound south take the south wind on an easy bowline steering west until they run out of the south wind into the S E trade when they hold on with port tacks aboard until they reach the belt of west winds; then they run back to the coast. In making this voyage Fernandez happened on the island called by his name but often Robinson Crusoe's Island, it being the scene of that hero's adventures.⁴

LATER VOYAGES TO THE STRAIT OF MAGELLAN.

Three years after the Victoria's return to Spain; on July 24, 1525 a squadron consisting of 7 ships sailed for the Strait and Moluccas; Commendador Garcia de Loaysa commanded and Juan Sebastian de Elcano commanded one of the ships. The squadron reached the Moluccas at the end of 1526.⁵ They entered the Strait Jan 24, 1526 6 months after leaving Spain and cleared it in 120 days; a long time to make 110 leagues which they report the length of the Strait. From Cape Deseado now called Cape Pillar the west entrance of the Strait to the Moluccas the ships were 7 months. The voyage was made in leisurely fashion but there was no hesitancy in following the way taken by Magellan. Loaysa's instructions required him to discover no land nor touch in Portuguese limits, to continue the traffic with the Moluccas, and to remain in them as governor.

A fleet sailed from New Spain for the Moluccas Oct 1527, being despatched by Cortez the conqueror of that country. Its commander

⁴ Chron Hist Disc in South Seas Burney 5 vs v 1, p 273.

⁵ Navar v 5 pp 5, 57, 411. Nearly all this v is about Loaysa's voyage: see also Desc del Estr Magal cited above n 2 pp 575; and 621 and foll'g below as to Drake and Sarmiento in the Strait.

was Alvaro de Saavedra.⁶ It was 5 years since the Victoria had returned to Old Spain and the news his countrymen were in the Moluccas must have reached Cortez across the Atlantic: perhaps word was sent to despatch ships when Loaysa sailed from Old Spain. Saavedra arrived out the year after sailing and sailed for New Spain again towards the close of 1528 going north for the west winds: but the voyage was unsuccessful and he returned to the Moluccas. Again in May 1529 he sailed and when the ship had reached 27° N Saavedra died exhorting the people in the ship to go on to 30°. She went as far as 31° and then owing to sickness and shortage of water and food returned to the Moluccas.

THE SPANISH PLAN A SHIP CANAL AT DARIEN IN 1528.

Antonio Galvano who was governor of the Moluccas says Saavedra's ship,⁷ "Came back again to Molucca very sad because Saavedra died by the way who if he had lived meant to have opened the land of *Castilia de Oro* and New Spain from sea to sea. This might have been done in 4 places;" one is, "From Panama to Nombre de Dios being 17 leagues distance." Gomara born 1510 also speaks of a canal, "There are mountains," he says,⁸ "But there are hands too:" *sierras son pero manos ay*.

OTHER EXPEDITIONS TO THE MOLUCCAS; THE ROUTE HOME.

Another fleet sailed from New Spain for the Islands at the end of 1542 being under Villalobos, and arrived out April 1544; and a strong one left La Navidad New Spain Nov 21, 1564 under Legaspi⁹ and occupied the Philippines.

Some who have seen the monument to Legaspi and Urdaneta in Manila have been at loss as to who the last was and wherein lay his title

⁶ Navar v 5 pp 440, 442, 444: on the last page are orders of Cortez as follows, "As the principal cause of blasphemy is card and dice-playing both these shall be prohibited by proclamation or by other known means xx; but because in armies particularly those going by sea there is necessity of recreation or pastime you may permit a moderate amount of play as you may deem best in your presence. xx. No consent shall be given in the said vessels or in any of them to women from whom scandal may be expected to embark and in this you must exercise great vigilance."

⁷ Disc World Hakl; pp 208 about being governor and 180 as to return Saavedra's ship.

⁸ Hist Indias chap 104; the title of this chap is Of the Passage Which Might Be Made To Go Most Quickly to the Moluccas.

⁹ Burney Hist Disc in S Seas v 1 p 250; also Blair and Robertson's Philippine Islands: Navar does not go beyond Saavedra.

to fame. Urdaneta was of the Augustinian Order and went to the Moluccas in the squadron of Loaysa, which sailed from Old Spain 1525. He remained in the Islands until 1535¹ and then returned to Spain going probably by way of New Spain. Espinosa in the Trinidad in 1522 and Saavedra in 1528-29 attempted to go east from the Moluccas to New Spain and both failed and returned; both tried to go by the correct route, by going north and then east with the west winds. The Victoria went west by the Cape of Good Hope in 1522 but it is not likely other Spanish ships went that way because the Portuguese had many ships in these waters. When Legaspi sailed from New Spain Urdaneta was in one of his ships; the orders were not opened until the fleet was 100 leagues out and were found to require, "A portion of the army and the religious are to remain in the Philippines while Father Urdaneta with the other portion of the fleet returns in order to establish the route until then unknown as this was the object and chief purpose of His Majesty."²

It is commonly said Urdaneta showed the way to return to New Spain. The way is that attempted by Espinosa and Saavedra. Urdaneta sailed from the Philippines June 1, 1565 and reached New Spain Oct 3 following; 4 months and 3 days.³ We have confirmation of this in a letter Legaspi wrote the King dated Cebu May 29, 1565, "The ship acting as flag-ship in the voyage hither from New Spain is about to return to discover the return route to Your Majesty's Kingdom. The venerable Fray Andres de Hurdaneta sails in it; to him we refer in everything that has

¹ Navar v 5 p 382; being in Spain Urdaneta testifies, "I arrived in the Moluccas in Loaysa's armada in the beginning of 1526 and since that time I have been continually in the said islands and near-by until the year 1535 passed when I came to this Kingdom." He was testifying at Seville about Loaysa's voyage and the Moluccas: p 384 same v he testifies, "I saw Captain Loaysa die; then the people of the armada (*la gente del armada*) elected for captain Juan Sebastian del Cano; and when in a few days he died, they elected Toribio Alonso de Salazar, who also died before we reached the islands; then they elected another whose name was Martin Iniguez de Carquizano; and with this Captain Carquizano the flag-ship arrived at the islands alone with 105 persons. Since leaving the Strait until we arrived at the islands more than 40 persons had died."

² Blair and Robertson's Philip Isl v 23 p 131: Hist Augustinian Order in the Fili Isl Medina p 122 same v; Medina wrote in 1630.

³ Grijalva Cron Ord Augustinian Nueva Espana, pp 122-3. P 123 is stated maps made by Urdaneta of the Pacific were in use in 1624 when Grijalva's book was printed. They must have supplied much of what is on the maps Anson found in the Spanish galleon he captured in 1740-4 and in some eds of Anson's Voy a map purporting to be copy of the Spanish chart is included. It is a good sailing-chart and on large scale: another good chart of about the same date is shown in Nav Tracts Monson Eng Nav Rec Soc v 2 at beginning. The last is of the Azores and its date is 1597.

happened here xx.”⁴ In the History of the Augustinian Order we read,⁵ “Urdaneta was the one who had been expressly ordered by His Majesty to discover the return route hitherto unknown to everybody:” much follows about winds etc hard to understand but it is clear the ship went well north; the chronicler goes on, “The entire weight of the voyage was loaded on our Argonaut who made it. Every day he cast the lead took observations and did everything that seemed advisable. xx On arriving at port he made a chart showing all their routes winds points and capes so completely that even today his chart is followed without any additions.”⁶ This was written by Medina in 1630. When Urdaneta made this voyage he was a little less than 67 years old.⁷ He died in New Spain.

It cannot be no ship returned to New Spain from the Moluccas from the time Espinosa and Saavedra attempted to do so in 1522 and 1529 until 1565, the date of Urdaneta’s voyage. Urdaneta must himself have made the passage, for he testified in Old Spain in 1535 he had gone out in Loaysa’s squadron in 1526.⁸ It is impossible the first return voyage to New Spain was not made until 1565 when the Spanish had been in the islands 45 years. Indeed it is recorded a ship made the passage just ahead of Urdaneta’s reaching New Spain 3 months before his.⁹ As this ship and Urdaneta’s both made good passages the way to manage the voyage must have been commonly understood. There are records of other attempts to go to New Spain before Urdaneta, “In the same year 1543,” Galvano writes,¹ “The general Rui Lopez sent one Bartholomew de la Torre in a small ship into New Spain to acquaint the Viceroy xx:” Torre found an island where were offered pilots to take him to China “5 or 6 days’ sailing thence:” the record does not say if the ship reached New Spain. Another ship tried to reach New Spain from the Moluccas by going south of the equator; not the correct route to New Spain but correct if bound to Old Spain by Magellan’s Strait. She should go as in the northern hemisphere south to 35° or 40° latitude and thence east in the west gales. No ship made this run the longest in the world until

⁴ Philip Isl Blair and Robertson v 2 p 176.

⁵ B and Robertson, v 23 pp 175-178.

⁶ V last cited p 122. The *points* he showed, *puntos*, are ship’s positions pricked on the chart.

⁷ V last cited p 178.

⁸ N 1 just above.

⁹ Burney Hist Disc S Seas v 1 p 270.

¹ Disc World p 234 Hakl.

Captain Cook and his consort 250 years later.² The record of the early Spanish voyage by the south just alluded to is as follows,³ "In the same year 1545 Rui Lopez de Villalobos sent from the Island of Tidori another ship toward New Spain by the south side of the equator xx. They sailed to the coast of Os Papuas and ranged all along the same and because they knew not that Saavedra had been there before they challenged the honor and fame of the discovery." The north shore of Papua is inclined from just north of the equator at its west end to 10° S at the east end. Nothing more than what is quoted is told of this voyage but the ship cannot have won through.

THE SHIPS USED IN THE GREAT VOYAGES.

The outlines of the stories of the Great Voyages are completed and others as to somewhat later date will be entered on but before passing to these a word may be said regarding the ships, their rig and sea-worthiness. The habit of putting one mast with one sail only in all ships except those of large size passed away in Europe probably before 1300, by the end of the Crusades; and the larger ships of Columbus and Gama had 3 upright masts and one much-inclined forward, the beginning of the bowsprit. The 2 forward and inclined masts had square sails; one on the inclined one, one on the mast next and to this a single bonnet laced; 2 on the next mast, a course and a topsail with 2 bonnets on the course; and the after mast had one large fore-and-aft sail. The vessels were 90 to 100 feet long 30 to 35 feet beam drew 9 to 12 feet and had one end-to-end deck. According to present views they were small and were of course as uncomfortable as small craft are: they were however seaworthy and could carry water and provisions for long period. The ships Dias had were smaller, for by direction of the King he built larger and higher ones after he returned for Gama. Magellan's ships were like those of Columbus and Gama. It seems probable these vessels were not as high at bow and stern as commonly represented. They had a *castillo* forward and aft, the crew living in the former much as is the custom now and officers and passengers in the last; but the towering structures carrying scroll-work and surmounted by huge lanterns shown by artists on ships had perhaps little existence. Danger in bad weather limited their height.

² Below p 657. From the Moluccas it is 5000 miles always near islands to 35°S; then 7000 east to the Strait with no land near.

³ Galvano Disc World p 238, Hakl.

The forward bulkhead of the after castillo and after one of that forward were pierced for guns and from here and in similarly arranged places in the waist the crew fought an enemy who gained their deck. These were called *close-fights*; war-vessels and traders alike had them as long as ships cruised for plunder; that is until late day. Vessels intended to explore waters little known have always been small; the leviathans of trade-routes go only where there are good charts and plenty of water. The burden of ships of early time is often given but we do not know what it means. That Drake's ship Pelican, "Required 13 feet of water to make her float" ⁴ is the most reliable datum I know regarding the ships of the day and is the more worthy of regard because stated when the ship was aground in the Far East. The year was about 1575. In reconstructions of Columbus' and Gama's ships the larger are of 90 to 100 tons and 90 feet long. Such vessels carried crews nearer 25 than 50 in number and the weights in one carrying 50 with food and water for 90 days the fixtures of the men and necessary ship-gear would total about 100000 pounds. The hull to carry this would weigh perhaps its double and the weight of the loaded ship or her displacement would be about 130 tons; she would be about 100 feet long 30 feet beam and 12 feet draft. The vessels that carried supplies to the Holy Land during the Crusades 200 years before the Great Voyages and those built to carry produce of the East after the way was found were much larger: a carrack captured near the Azores is thus described, ⁵ "A Portuguese carrack was in 1592 captured by Sir John Burroughs. She was in burden no less than 1600 tons whereof 900 were merchandize; she carried 32 pieces of brass guns and between 600 and 700 passengers; was built with decks 7 story xx, 2 close decks, one forecastle xx. She was in length from the beak-head to the stern 165 feet in breadth near 47 feet; the length of the main-mast was 121 feet its circuit near the partners near 11 feet and her main-yard 106 feet."

Interesting incidents were common in the day. Drake captured a Spanish ship of great size and valuable cargo on the way from Peru to the Isthmus of Darien where the cargo was to be trans-shipped for Spain; Cavendish and Dampier both English combed the South Seas with like purpose but unsuccessfully not much later; and Dutch ships engaged in similar occupation. The British Admiral Anson brought down the last

⁴ World Encompassed Hakl p 156: p 6 same says she was 100 tons burden.

⁵ Charnock Hist Mar Arch v 2 p 10: see Jal Arch Nav v 2 pp 207-17 for other large ships.

quarry of this kind about 1745: he lay-to off Acapulco out of sight a long while with scout-boats near-in waiting for the galleon that went to Manila, but they had wind of it onshore and sailing was postponed. Later he captured a great ship which had just sailed from Manila for Acapulco and emptied her. The Manila-Acapulco galleon was still running in 1820 and until almost our day. In 1820 this trade was operated by an Ecclesiastical Corporation and the ships made the run Manila to Acapulco 9200 miles in about 150 days, 60 miles a day; crossing in 29° N; much too low.⁶

THE SEA EMPIRES OF SPAIN AND PORTUGAL.

Cargoes between the East and Old Spain were trans-shipped at New Spain that is Mexico and those from Peru at the Isthmus; none came by the Strait or Cape of Good Hope. The latter way was not followed by ships of Spain even after she seized Portugal, but Portuguese ships went this way, though sailing from as far east as the Philippine or Molucca Islands. Their ships went east of India; to Ceylon Malacca the Molucca and near-by islands and ports of China to the north, and to the south as far as Australia and islands near. Their viceroys had visions of an empire of boundless extent and wealth and disputed whether this should be made to rest on the ships alone or fortified places onshore. They had been in India only 25 years when Magellan arrived by the other way, and in 75 years more Dutch English and French ships, failing by the north-west or north-east passages, took the forbidden way around the Cape of Good Hope and the Portuguese Empire in the East came down before the onset of traders whose governments were content to look on. The loss was in truth Spain's since she had in 1580 seized Portugal and dependencies: of holdings in the East only the Philippines were retained, to be relinquished in our day. The Portuguese and Spaniards greatly injured the local sea traffic in the East and seem not to have attempted to restore it.⁷

SPANISH EXPLORING FLEETS GO WEST FROM PERU.

In 1567 2 years after Legaspi's fleet sailed from the west coast of Mexico and annexed the Philippines a fleet sailed west from Callao Peru. There were 2 ships manned by 150 men and commanded by Mendana and

⁶ Crawford Hist Ind Archi 3 vs 1820 v 3 p 338; p 289 same v extols American merchant-ships as the best-built and best-sailed in the East.

⁷ Three Voy Da Gama Hakl p 325.

they arrived in 80 days at Ysabel Island one of the Solomon group 600 miles east of New Guinea, having sighted other islands but not landed. They had crossed 120° of longitude or 7000 miles in the S E trade in latitude 8° to 15° : except where the Victoria had passed, these waters had never before been entered. Allowing for want of straightness in the course and being hove-to a time near islands they made good 100 miles a day. On reaching the Solomons they remained until August 11 and building a small vessel explored the islands and mapped them with such accuracy that the movements of the exploring craft may be followed today. August 11, 1568 the ships sailed for home steering first away up to 35° N, then east to what we call Lower California and thence coasting south to Peru. They probably knew their countrymen were in the Philippines but steered for a point in 35° N about 180° from Greenwich; about where Midway Island is.

They made Lower California in 130 days having followed a course 7500 miles in length, thus making good 58 miles a day; considering 2 belts of calms were crossed that the wind in the N E trade was scant and that both ships were dismasted and their boats swept overboard in a gale when 60 days from the California coast, we conclude the ships were good sailors. They anchored in what we call Sebastian Viscayno Bay and eventually in Callao, 20 months after sailing thence, having lost $\frac{1}{3}$ their men. Then happened a strange thing. The Solomon Group though large and described was lost and remained unidentified for 200 years. Mendana sailed for it again in 1595 but could not find it; Quiros who was pilot in this last expedition of Mendana commanded a squadron that sailed from Callao for the islands in 1606 but was unsuccessful; they were searched for later by Bougainville Cook and La Perouse.⁸

THE VOYAGES WEST FROM PERU.

In the first of the 2 voyages told of just above, the one in 1595, Mendana commanded and Quiros was chief pilot; in the second 1605 Quiros commanded; neither reached the Solomons though Mendana had gone there in 1568. Quiros explains why they were not found but it is unintelligible.⁹ In the first work cited n 8 are 2 modern charts, one showing the Pacific with the 1567 voyage plotted and the other

⁸ Disc Solomon Isl Hakl; in reference to the 2 later voy from Callao see Voy Quiros 1595 to 1606 Hakl.

⁹ Chap 36 2d work cited n preceding.

the Solomons with the track of the small exploring vessel plotted. Also in this work is shown a map called *Orbis Terrarum* drawn by Ortelius in 1589: it shows the Solomons and Torres Strait. Torres was in the expedition of 1606 commanded by Quiros and from the Solomons his ship proceeded west through Torres Strait between New Guinea and Australia.

Columbus went out in all his voyages in the trade wind and while some ships tried in days shortly following to beat back in the pleasant weather in the trades, nearly all from the first went north into the winds and then east. The way to go east and west in the N Atlantic was known in Columbus' time and while it must have been deemed likely winds were the same in the other hemisphere this was not known and exploring ships that went west from S America did not go south when they returned. We have account of 3 such voyages in close relation: all set out from Callao; one in 1567 commanded by Mendana and piloted by Galleygo, a second in 1595 Mendana again commander and Quiros pilot, and a third in 1605 commanded by Quiros. All went west about 7000 miles; in returning they went north to 30° and east in the west winds of the north hemisphere. Galleygo a noted seaman went with Mendana in 1567 and it appears a report brought in by him led to non-existing islands being drawn in the South Pacific: in the map of Janssonius of 1650 is shown a string of islands close together extending from Magellan Strait towards the Philippines and reaching $\frac{3}{4}$ this great distance; they are marked, "Islands from New Guinea to Strait of Magellan says Hernando Galleygo who explored them for the King of Spain in 1567."¹ These Islands seem to have been believed in for years and may well have had influence in preventing ships from coming east in high south latitude, for they are so close that in 30° to 50° S there would be danger while passing them.

Islands real and imaginary have played large part in voyaging; not a few have been put in different places at different epochs, and near some whose story seemed for a time purely mythical has been found land of wide extent, giving rise to the thought that they had been seen by ships out in their reckoning. How Galleygo believed he saw land to the south across the Pacific is hard to see. There is an amusing story of about his day indicating how sometimes land came to be drawn: Pedro Sarmiento de Gamboa who will be referred to again was a prisoner in England about 1590 and told Sir Walter Raleigh, who objected that a certain island on a

¹ Pl 57 Periplus Nordenskiöld; pl 59 is *Mappa Mundi Amsterodami* 1710 where these islands do not appear.

map made by Sarmiento had no existence, he had drawn it in to please his wife: she was sitting by him when he made the chart he said and he drew the island so she, "Might have an island of her own."² As regards ships being lost and wandering at sea it must be remembered that when reckoning was not carefully kept it could not be restored; latitude could be recovered but not longitude.

VOYAGES OF MENDANA AND QUIROS.

In the voyage of Mendana from Callao in 1567 Galleygo the pilot furnishes much of interest. He wrote the ship being among shoals, "I sent a man to the fore-top and another to the bowsprit telling them to notice when the water whitened and with the lead-line in hand and standing by all the bowlines and sheets with the anchor cleared in case it should be necessary to go about or to anchor I made them steer where there was 7 fathoms of water xx." When the ship is about to return to Peru from the Solomons, "They asked me my opinion about the return to Peru whence we had set out and I said decidedly xx it would *not be well to pursue our voyage south* of the equinoctial line as we should be lost since we were many and we had but little food and but few vessels for storing water and that if we did attempt the voyage that way xx there was no land in the direction of the S S W and S whence fine weather might spring xx. I gave it as my opinion we should go in search of the north x x. On the 11th of August we went out from Puerto do Nuestra Senora which is in 11° S of the equinoctial to pursue our voyage towards Peru."³ The next day Galleygo reports the latitude 7° S.

The ships went north. Mendana narrates before they left the islands, "When the ships were ready and I had consulted the pilots as to the course we ought to follow in returning to Peru my intention being to steer S E and E S E if the weather served in quest of the coast of Chile as I told them many times. x x x x x x The said pilots determined we should go in quest of New Spain although before we put out as well as afterwards I bade them consider many times the course they were following, saying that by way of New Spain even with very favorable weather

² Voy Sarmiento to Strait Mag Hakl p 341: Sarmiento states he talked to Queen Elizabeth in Latin for 2 hours.

³ Disc Sol Islands Hakl v 1 pp 19 and 62. Where the text has S S W it should be S S E: the two are very like in Spanish and there would be no sense in going S S W. The latitude stated for the Puerto is correct.

we could not reach Peru in 6 months and further that we were navigating in the wrong direction in going north in the winter season.”⁴

The views of Sarmiento are given thus, “The pilots gave their opinion regarding the course they should take and Pedro Sarmiento gave the course of the ships with all the bearings and stated his opinion they should follow a S W⁵ course in search of the other land which he wished to discover lying opposite to Chile. The 3 pilots were of his opinion: Galleygo although he also said he should do so did not perform what he had promised but steered instead for New Spain.” Mendana says,⁶ “Every time the wind served to steer S E and E S E I ordered the ship to be sailed according to the wind. xx Seeing I persisted in going S and not N and that I did not follow the advice of the pilots the soldiers came to me and begged me for the love of God not to order the ship steered in a direction in which we must all perish and be drowned. The seamen clamored also and they were so weak they could hardly work the sails.” Mendana yielded and the ship went north. In Mendana’s voyage in 1595 when Quiros was pilot the last says Galleygo, who was not in the later expedition but whose sailing directions he had,⁷ “Reports it was better to take a northern route in returning to Peru because it was hard to find favorable winds further south. Few pilots would give this reason because the usual winds outside the tropics in the same latitude are much the same on the north as on the south side.” Yet even in the later voyage in which Quiros commanded the ships returned by the north.

In the voyage in which Mendana commanded and Quiros was pilot sailing 1596 the ships went to Manila on the way to New Spain. Mendana died in the Solomons and his wife always called “The Governess” controlled the expedition afterwards; “The Governess proposed to the pilots,” we read,⁸ “Her determination was to go to the city of Manila in the Philippine Islands;” and just following this it is written that in

⁴ P 183 work cited. The distance to California is 7500 miles whence to Callao is 2500 miles. From the Solomons S S E to 35°S and thence E to Chile the distance is 7250 miles: the last was shorter and as Mendana urged they were in high northern latitude in mid-winter.

⁵ Mistake for S E.

⁶ Work cited v 1 p 184; also v 2 p 426 Opinions and Testim Pilots Nav in Regions Equinoctial dated Sept 4, 1568 2 weeks after leaving the Solomons. The pilots wanted to go north and Mendana, either because he hoped to find more lands or reach west winds, south.

⁷ Voy Quiros 1595-1606 Hakl v 1 pp 142, 65.

⁸ Work cited note next above v 1 p 10.

setting out for the north, "The Chief Pilot made the course N W with the wind S E to avoid New Guinea which was very near. x x We navigated only by information and without a chart ⁹ seeking for the Cape of Espiritu Santo the first land of the Philippines." When they neared the destination and saw land Quiros the Chief Pilot writes, "The Chief Pilot said x x I never saw the land in my life until now nor am I a sorcerer, I came in search of the Cape of Espiritu Santo. It ought to be here within 2 leagues more or less." It was; the ship anchored and "During 3 days and nights the galley fire was never put out." ¹ The ship and sails and rigging were in dilapidation and the men sick and starving, much of which is chargeable to penuriousness of the Governess who would not allow food to be issued when there was some onboard; but they were navigating by information and could not tell how long the voyage was: when preparing to leave the Solomons in the voyage preceding this one Mendana, "Repaired the ships taking in supplies of food and water for 41 days; ² yet they were 125 days to Lower California and Midway was perhaps the largest island they were near and in such places the difficulty of watering would be great and proper food could not be had.

A GENERAL CHART OF THE PACIFIC IN ABOUT 1590.

Of the Bay of Espiritu Santo in the New Hebrides Islands 16° S and 167° E from Greenwich our pilot writes,³ "This bay is 1700 leagues from Lima from Acapulco 1300 from Manila in the Philippines 1100. The harbor is about 15° 30' S." The distances named are correctly in miles 6650, 5700, 3850; those given taking a league at 4 miles are 6800, 5200, 4400. The error in the last is the greatest as is natural because the Philippines were the last occupied by Spain and until this one no ship had gone between the Hebrides or Solomons and Philippines.

WATER DISTILLED IN SHIPS.

Quiros records he distilled water for drinking and cooking; "He ordered a brick oven to be built over one of the hearths in order to make sweet water from sea-water with a copper instrument he had with him by means of distillation. They got 2 or 3 jars-full every day very good and

⁹ Only 30 years had elapsed since Legaspi occupied the Philippines and it was a long way for information to go, Manila to New Spain and thence to Peru.

¹ Same work v 1 pp 104, 116, 120.

² P 426 v 2 Disc Solomons.

³ Voy Quiros Hakl v 1 p 263.

wholesome:" again, "On this day the hearth was arranged and the apparatus for obtaining fresh water from salt. The fire was lighted over the machine and it began to give fresh water. This day they got 3 Peruvian jars full. The water was found to be clear soft and good for drinking:" again when 80 days out from Callao, "We stood up to it or luffed to collect some water. We suffered much for want of water and the machine could not produce any for want of fuel for we had come to an end of it and none for cooking." ⁴ The date of this is 1606. There is an earlier case in the Observations of Richard Hawkins in His Voyage into the South Sea 1593: here we read, "Although our fresh water had failed us many days before we reached the shore x x yet with an invention I had in my ship I easily drew out of the sea sufficient quantity of fresh water to sustain my people x x; for with 4 billets I stilled a hogshead of water and therewith dressed the meat for the sick and the whole. The water so distilled we found to be good and nourishing." ⁵ The practice of distilling water for drinking, pretty much disused when sailing-ships carried large iron tanks fitted to the shape of the hold, was common in former days: in the Voyage of Leguat about 1690 it is recorded, ⁶ "Although each ship of our fleet had 2 men who were hired to make every day the sea-water fresh yet we found that water so maukish that the best use we made of it was to give it to our animals and to boil our meat with it." There were also improvements devised in distilling apparatus for use at sea. ⁷

FURTHER MATTERS OF INTEREST IN THESE VOYAGES.

(1) When approaching California from Manila Quiros' ship kept lookout for a floating weed called *porra*; when it was seen she changed course to S. ⁸ This is a legitimate enough sign; there is another which though from a sober and industrious seaman to us seems a joke: Linschoten says in approaching New Spain you will see great black birds and if toward evening one of them, "Extends his right leg near his tail be careful for that signifies a storm." ⁹

⁴ Voy v 1 p 196 v 2 pp 333 350.

⁵ Obs Sir R Hawkins Hakl p 82.

⁶ Voy Hakl v 2 p 301.

⁷ Acct Useful Disc to Distil Double Sea-Water 1756; Philos Expts Showing how Sea Water May be Made Fresh 1739; both by Stephen Hale.

⁸ P 290 v 1.

⁹ Hist Nav Linschoten Amsterdam 1619 p 119: there are several eds of L who went to sea first 1579; in the ed in Hakl 2 vs p 16 v 1 is described games when crossing the Line in 1583.

(2) As to commonness of compasses in these days, a young sailor took bearings from aloft in Quiros' ships, "With a compass he possessed."¹

(3) Quiros writes,² "There was a pilot named Juan Fernandez who discovered the track from Lima to Chile by going to the west which till then had been made with much difficulty as they kept along the shore where the south wind prevails almost constantly."

(4) For Jan 14, 1606 the log of Quiros' ship has this entry, "This day we set a main top-gallant sail."

THE UPPER SAILS OF SQUARE-RIGGERS.

As has been stated ships until about 1430 had usually one mast and on this one sail, though larger ships had more masts. The use of topsails is very old: the date of the topgallant sail in Quiros' ship is 1606 and Jal says of *perroquet* which is French for topgallant sail,³ "We see for the first time in 1525 the name *perroquet* in an historical work." Jal believes topgallant sails became usual after 1600 and royals after 1700.⁴ In later day and in ships with a reputation to sustain or seeking one royal studding-sails and sky-sails above the royals were common enough.

Some have thought the term topgallant was derived from a similar name applied to topmen who went aloft above the topsail, but Charnock cites a writing of 1515 which may point to a different derivation; to wit a list giving costs of articles for the ship *Mary* and *John* wherein is this item, "For a garland for the topmast" and in the same list, "The *Mary George* into the *Levant*; here we find the term top-garland which we now corruptly call top-gallant."⁵ Charnock indicates belief the word topgallant was derived from top-garland and there is a probability a top-garland was a short upper mast for ships carrying no sail above the course; it was perhaps a pole above all sails as now the part of the mast above the royal yard when hoisted is called pole. Jal suggests the French and Spanish words *perroquet* and *juanete* meaning topgallant sails, *cacatois* or *catacois* and *sobrejuanete* meaning royals, and *papafico* or *papa-*

¹ Voy p 296 v 1.

² P 526 v 2.

³ Word *perroquet* Jal's Glos Naut: there are curious customs in Jal about this and other sails.

⁴ Arch Nav v 2 p 192. Charnock Hist Mar Arch v 2 p 286 shows *Sov of the Seas* built 1637 with fore main and mizzen topgallant sails and fore and main but no mizzen royal.

⁵ Mar Arch v 2 p 104: see also word *garland* in Jal's Glos Naut. Charnock's date is 1801.

figo the lower sail, may be derived from the names of certain birds; though other derivations have been suggested.⁶ The French call a topsail *gabie* and the word used by other Mediterranean nations is nearly the same: it is said to come from the Latin *cavea* or *cavata*, a cage or hollow, and to have been applied because at the head of the masts there was an enclosed platform where look-outs and combatants were posted and the Latin word from the Hebrew *gabis* also meaning a cage, for the terminology of the sea was no doubt influenced by the Hebrew language and the platform or cage at the top of masts is as old as the Hebrew tongue.

As respects sails the illustrations in Fournier's *Hydrographie* 1667 and Hoste's *Art des Armées Navales* 1697 show fore and main topgallant sails but none on mizzen. Most of the ships-of-the-line shown have sprit-sails under the bowsprit and when in battle have these furled. Yet with sails of no sort forward of the foremast ships were often tacked, stayed not worn, in battle. The co-temporary picture of the Battle of Solebay 1672 published by the English Navy Record Society furnishes the following information about sails: the ships were English French and Dutch:

(1) Large ships carry sprit-sails under the bowsprit but none are set in fight.

(2) There is no sail on a stay between masts; no large ship has a triangular jib before the foremast⁷ but small craft have these, several having more than one in this place.

(3) Some small craft have a triangular jib forward a square sail and a fore-and-aft sail with a gaff—not lateen yard—on a single vertical mast; being rigged like what we call a topsail sloop; and have a deep flowing square sail. One of the last has a line of reef-points close up to the gaff, showing the sail was reefed on the head.

(4) The large ships have a long lateen yard on the after mast and a square topsail above this.

(5) Some courses and lateen sails are clewed up to their yards; no topsails or topgallant sails are shown clewed up; several topsail yards are down almost on the lower yard, the sail being sheeted home and belling out.

(6) Three of the large English ships have fore and main topgallant sails set but no topgallant yard or mizzen. Three others have fore and main topgallant yards but no sails set on them.

⁶ Arch Nav v 2 p 192 note; also Glos Naut.

⁷ Below p 659 as to triangular jibs, also 623 n 7.

(7) One small one-masted English vessel has main-sail topsail and topgallant sail, all square, two triangular jibs forward, no spanker.

(8) Reef-points like those of today show on topsails of 4 large English ships; none on any of the courses or topgallant sails; on some of the topsails two rows of reef-points show. No bonnets to reduce sail by unlacing them are shown. A century earlier bonnets were universal. The attempt to generalize the arrangement of masts and sails must be regarded as having many exceptions.

THE CLOTHING AND DRESS OF SEAMEN.

In 500 B C a man dressed in the manner of seamen was written of⁸ and while this tells nothing of the garments worn it shows seamen could be recognized. There are designs on ancient and mediæval coins showing ships and in some are sailors but the scale is very small. The oldest pictures of seamen are on the carvings of Egypt and Nineveh and Acropolis at Athens.⁹ The dates of the Nineveh and Acropolis carvings are 700 and 300 B C and while the men show plainly being dressed in a loose shirt there is no indication of peculiarities of dress. Seamen except those on government military service have probably always worn garments like those of laborers onshore, subject to the requirement they must be suited to going aloft, and this is still the practice. Jal gives an order of the French minister of marine of 1678, the first regulation regarding uniform in the French Service;¹ the men were to wear a shirt of red cloth with copper buttons blue pantaloons with red stockings blue caps and a neck-cloth.

VOYAGES IN THE STRAIT OF MAGELLAN LATER THAN THE EARLIEST.

Of voyages to the Strait after those of the first Spanish ships only that of Drake west in 1578 and Pedro Sarmiento de Gamboa from Peru to Spain a little later will be noticed. Drake sailed with 5 ships from Plymouth Nov 15, 1577 and returned Sept 26, 1579 having taken a turn about the earth westward. There was insubordination before he entered the Strait caused by the difficulty and danger of what was about to be undertaken or by the fact that persons disaffected toward the commander had been put in the fleet, and Drake quelled this by vigorous measures. The

⁸ Sophocles Tragedies Jebbs trans Philoctetes p 41; "I will send the same man xx disguised as the captain of a merchant-ship." (*Naukleros* in Greek.)

⁹ Above illustr pp 34, 74.

¹ Glos Naut word *costume*.

ships were in the Strait August 20 to September 6; a remarkably quick passage. The cape on the north side of the east entrance of the Strait now called Cape Virgin and by Drake Cape Virgin Maria was determined to be in latitude 52° S and Cape Pillar at the west end $52^{\circ} 30'$; modern tables give them $52^{\circ} 20'$ and $52^{\circ} 43'$; the results are close and were almost certainly determined on shipboard. The longitudes are not stated.

It is curious that insubordination in Drake's fleet occurred where Magellan's trouble occurred; in the Bay of St. Julian 250 miles north of the Strait. Drake executed the disaffected, and it is said his men found the gibbet set up by Magellan 60 years before and near-by the bones of a sufferer Juan de Cartagena and buried these placing stones at head and foot.² The custom of the day often confirmed by special royal order of consulting all onboard in regard to what was to be done must have been provocative of trouble, but we shall find Drake doing it. Hands before the mast knew the danger of projected voyages and were generally willing to avoid them. The habit must have been passing out in Drake's day and is not read of after 1600. At the Strait Drake changed the name of his ship from Pelican to Golden Hind. From Cape Pillar he was driven south as far as 57° and somewhat further; on the weather improving he came north to 55° and anchored near islands. It is possible Cape Horn $55^{\circ} 59'$ was seen at this time. In establishing the latitudes given the altitude of the south pole by the Southern Cross or meridian altitude of the sun was probably used.³ As sailing-ships have always gone around the Horn to avoid the currents and violent and uncertain winds in the Strait its discovery is of interest; the name was given in later day in circumstances which will be described.

The bad weather off the Horn lasted 52 days the season being early spring: eventually, "The men being worn out with such intolerable toil" the ships squared away before the coast-wise wind and went to Valparaiso and Callao.⁴ In these harbors Drake hoped his consorts, separated in the heavy weather at the Cape, would join but they did not and he went on north alone. Near Cape San Francisco $0^{\circ} 39'$ N he over-took captured and emptied the treasure-ship *Cacafuego* whose sail-

² P 70 World Encomp Drake Hakl.

³ P 13 Drake World Encomp Hakluyt records, the ships being $20^{\circ} 31'$ S, "The South Guards called the *Crosiers* $9^{\circ} 30'$ above the horizon." The Cross is 20° from the pole and in the latitude stated would be visible throughout its revolution. It is not stated if this altitude was used for latitude.

⁴ Stated to be $35^{\circ} 40'$ and 12° S; correctly $38^{\circ} 02'$ and $12^{\circ} 04'$.

ing from Callao 14 days before him he knew of. The record says her cargo was,⁵ "Valued in all at about 360000 pezos: we gave the master a little linen and the like for these commodities and at the end of 6 days we bade farewell and parted, he hastening somewhat lighter to Panama and we plying off to sea."

It was believed in Spain Drake was to find another way to return to Europe from the South Sea but is not clear what his purpose was except to spoil the Spaniard and sail in his sea. Some think he hoped for a passage through America in the north for he went in that direction though perhaps because Panama and New Spain would be too hot for him. He was as far north as 45° or 48° and then came south to a harbor north of San Francisco still called Drake Bay whence, "With the *general consent* of all the ship bent her course directly to run with the Islands of the Moluccas."⁶ Though Drake consulted his men he usually kept aloof surrounded by ceremony as is shown by the records cited note 2d above. In these will also be found circumstances connected with his kidnapping Portuguese and Spanish pilots with their navigation instruments charts etc for guidance in his voyage.

Drake's ship made good 50 to 100 miles per day. About 10 years after him another English seaman Thomas Cavendish went around the world; and in Drake's World Encompassed is a map made after Cavendish's return showing the track of his ship and Drake's.⁷ Drake was a prime seaman. The pilot Nuno da Silva himself a seaman says of him, "Francis Drake is a man aged 38, x x he is low in stature, thick set and very robust. x x He is a great mariner the son and relative of seamen and particularly of John Hawkins x x. He took with him from England 170 men amongst whom there were some he made of more account and had seated at his table; namely the captain pilot and doctor. He also read the Psalms and preached x x. His ship has 2 *sheathings* one as perfectly finished as the other x x. She is not new nor is she coppered x x. She is *water-fast* when xx the wind is astern and not violent, but when the sea is high she leaks not a little whether before the wind or with bowlines hauled out. x x Francis Drake carries with him 3 books on navigation; one in French one in English and the third was Magellan's Discovery. He

⁵ World Encom p 111: see also New Light on Drake Nuttall Hakl.

⁶ World Encom p 134.

⁷ This shows ships like those Drake and Cavendish had. There are in all 4; each with 2 square-rigged masts carrying only a course and topsail and one long lateen yard; seemingly no triangular jibs or stay-sails.

kept a book in which he entered his navigation and delineated birds trees and sea-lions. He is an adept at painting and has with him a boy a relative of his who is a great painter. When they both shut themselves up in his cabin they are always painting.”⁸

Several of Drake's latitudes have been given and they are nearly correct. Edward Cliffe a pilot who was with him describes how to use the Southern Cross for latitude and says about longitude, “The 15 of September the moon was there eclipsed presently after the setting of the sun about 6 of the clock at night, being then Equinoctial Vernal in that country. The said eclipse happened the 16 day in the morning before 1 of the clock in England, which is about 6 hours difference, agreeing to one quarter of the world from the meridian of England toward the west.”⁹ This is much in error; the longitude of Cape Horn which was near is 67° 16' W of Greenwich, 4½ hours; the record is worth repeating only to show the pilot knew the theory of longitude determination and that the ship carried a book or manuscript giving positions of heavenly bodies for a time beyond her sailing. The hour at the ship was determined by observation of a heavenly body at the moment of or before or after the eclipse, with a sand-glass to measure the duration of the period intervening if any: such were the facilities of the day. Drake procured information from Portuguese and Spanish seamen. A letter written in Spain to King Philip dated Aug 31, 1579 has this,¹ “It is understood that before starting from England for the South Sea Francis Drake spent several days in Lisbon endeavoring to ascertain the navigation route of the Portuguese from East India hither. According to what is at present thought his purpose is that if on that voyage he should enter the South Sea it would be very difficult to return through the Strait or over tierra firme. x x He carries a map of the said voyage.”² He captured several persons who might be useful in showing the route. One of these a pilot for China he told, “He would not want him to do more than reconnoitre land because

⁸ Pp 301-3 New Light on Drake Hakl, deposition of Portuguese pilot Da Silva captured by Drake and taken with him. The 2 *sheathings* may have been put on because the ship was old in the way the Chinese kept old ships going. *Water-fast* means not leaking no doubt.

⁹ Drake World Encompassed Hakl p 271 for latitude by Southern Cross; p 280 for eclipse. The eclipse occurred after the ship had passed the Strait of Magellan when driven south.

¹ P 405 New Light on Drake Hakl.

² The writer was in error; Drake did not believe it difficult to return east by the Strait, p 90, World Encomp: he had 4 ways to return, p 162 New Light on Drake.

all that concerned latitude and the knowledge of the Star would be attended to by himself." This pilot Drake, "Took with him x x his 2 navigation charts and collection of charts and set sail" but soon released him, having "hanged" him first and, "Taken from him all the letters he carried and his navigation charts and never returned him more than 2 sea-charts and a fore-staff."³

Drake has been charged with brutally hanging prisoners, but there were 2 ways of hanging, a fatal and non-fatal kind. In the deposition of Francisco Jacome is this,⁴ "After having set me free x x the said Englishmen returned in a launch and carried me back to the ship and wanted to hang me demanding the gold they said I had hidden x x. As I had not hidden anything whatsoever and was unable to reveal anything to them they hanged me by the neck with a cord as though to hang me outright and let me drop from high into the sea, from which they fetched me out with the launch and took me back to the ship x x. It was thus I parted from them."

VOYAGE OF PEDRO SARMIENTO DE GAMBOA FROM PERU BY THE STRAIT TO SPAIN; HIS OBSERVATION FOR LONGITUDE IN MID-ATLANTIC.

Sarmiento went to Peru 1557 and sailed from Callao for Spain by the Strait October 1579. There were 2 ships, Capitana, in which was Gamboa who styles himself Superior Captain and General of the Squadron, and Almiranta. He was to survey the Strait with a view of fortifying it to prevent vessels except those of Spain from passing and to watch for Drake, "To kill and destroy him fighting with him at whatever risk."⁵

³ Pp 183-4, 193 New Light on Drake: the fact that a fore-staff and not astrolabe is mentioned should be noted. Pl vi this work is a map on which is written "*Carte veuee et corrigee par le dict Siegneur drack*" which shows the track of Drake's ship: this is in the Library of the Hispanic Society in New York but the showing Drake saw and corrected it is not clear.

⁴ Pp 149-51 work cited note next preceding. Customs of the day were rough: it was not unusual to "make water-spaniels" of men in captured ships, drive them overboard and leave them swimming about; but customs in war are now as rough as ever. In ordinary times men were "keel-hauled," dragged by a rope from one side of a ship to the other under the keel. The French word *cale* is given in Littre's dictionary as a punishment: there were 2; *cale* was suspending the culprit from a yard and dropping him into the water or near it—this seems to have been what "hanging" consisted in; also, *grand cale* was dragging him under the keel. The last was put in effect only if it mattered not if it was fatal: the term keel hauling was commonly known to seamen; see below p 636 as to punishments.

⁵ Voy Gamboa Hakl p 9: they thought Drake would return that way; his ship had been in Callao and captured the treasure-ship sailing thence for Panama a year before Sarmiento sailed; above p 622.

They did not meet Drake and remained in the Strait to survey it and the survey made is still referred to with respect. Sarmiento did a much more notable thing when the ships went on to Spain from the Strait; he observed for longitude March 31, 1580 in the South Atlantic Ocean writing,⁶ "That day we should have sighted the coast of Brazil in conformity with our observations and dead-reckoning but there were currents taking us east. Our perplexity was very great. x x We knew our position as regards latitude but were ignorant of our longitude. Sarmiento (he means himself) knew how to find it but had no instrument for observation. x x Sarmiento made a kind of cross-staff⁷ with which with God's help on the 31st of March, 1580, the General took the degrees of longitude by the full of the moon and the rising of the sun and found we were in 18° W of Seville."

The same night he found by the Southern Cross latitude 21° 30' S; the ship was 21° 30' S and 18° W from Seville; 24° W from Greenwich. The angle between the sun and moon since the former was rising and the last full was very great which added to the difficulty of observing, but the fatal difficulty was that the tables of the moon's position, in no way mentioned by Sarmiento, must have been far from correct. We can follow further this first longitude at sea and get an inkling of its accuracy: 9 days after the observation was taken they saw land and Sarmiento writes, "When he saw it Pedro Sarmiento said it was Ascension which is on the route to India. He knew this from the observation he had taken by the dead-reckoning with his observed longitude x x. In order to reach the island he braced up and hauled out the bowlines x x." Ascension is 7° 56' S and 14° 25' W of Greenwich; 1000 miles N N E of the position determined 9 days before by the Southern Cross and moon: as to accuracy of the observation no more can be said than that 1000 miles is a reasonable run in 9 days and N N E the course that was probably steered. Sarmiento landed⁸ and writes while onshore in Ascension, "The 12th April Sarmiento took the longitude at 6 h 12 m in the morning and after working it out found the Island of Ascension is in 3° W of Cadiz which is further to the

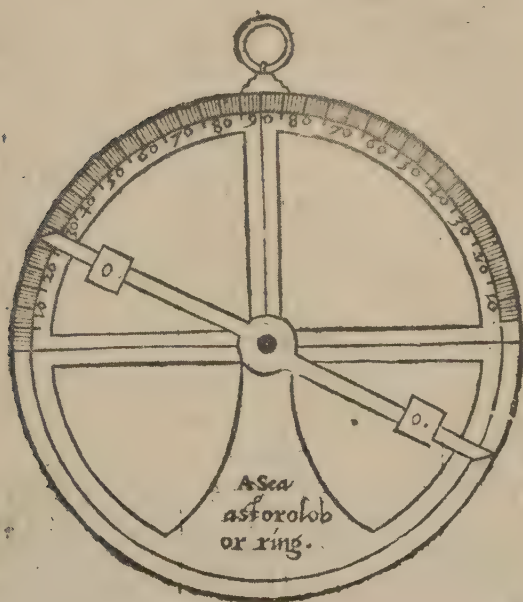
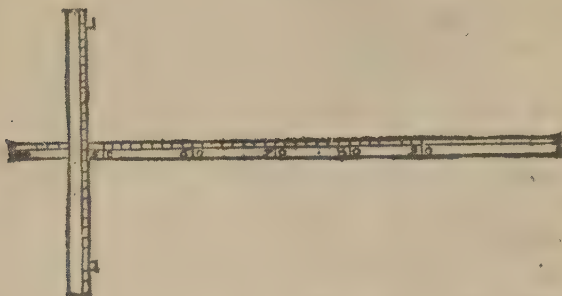
⁶ Work cited note next above p 163: the expression *in conformity with our observations and dead-reckoning* was written by Sarmiento *conforme a la derrota y alturas*; see Spanish ed of his work at the N Y Public and Philadelphia Libraries.

⁷ He wrote *un genero de baculo o ballestilla*: see picture here inserted of Balla Stella in Bourne's Regiment of the sea; printed first in 1570.

⁸ P. 163.

The Regiment for the sea.

The Balla Stella, or Crosse
Staffe: to take the heighth of the Sunne
or Starre,



The

This is the cross-staff and astrolabe—here called balla-stella and sea astrolab or ring—shown in Bourne's Regiment of the Sea printed first 1570 about. To measure the large angle he used Sarmiento's cross-staff must have differed materially from this one.

east than it is placed on Portuguese charts by a whole degree, equal to $17\frac{1}{2}$ leagues." Ascension is correctly $8^{\circ} 07'$ W from Cadiz.

William Baffin recorded 2 observations for longitude, the first made onshore and a second when his ship was fast in the ice: the record of the first is as follows; "The 8th day of July 1612 in the morning I perceived the sun and the moon both very fair above the horizon x x. At which time I purposed to find the longitude of that place by the moon's coming to the meridian x x." No result is stated. Again in 1615, "The next morning being fair and almost as steady as onshore x x having my quadrant ready; x x it being indifferent large as of four-foot diameter x x;" he goes on to find longitude. Again no result is stated.⁹

SARMIENTO DETERMINES LONGITUDE ONSHORE IN 1577 AND 1578.

Sarmiento's observation for longitude at sea seems not far out and the one in Ascension 5° in error. From him we have also the earliest record of systematic attempt to determine local times at many places of a phenomenon which appears everywhere at the same instant, such as the moment the moon begins to enter or emerge from the shadow of the earth; the differences between such times being differences of longitude. Being in Spain having come there from Peru he wrote,¹ "Pedro Sarmiento de Gamboa began to work at the preparation of charts for the voyage jointly with the Licentiate Rodrigo Zamorano Cosmographer Professor of Mathematics and of Pilotage to the Casa de Contratacion ² Examiner of Charts and Pilots for the Royal Council of the Indies who is learned in the art and with Anton Pablos x x. All the ancient and modern charts and *padrones* were brought into the room to examine the difference of positions of places as regards longitude and by them to delineate the coast line. The 2 positions which were considered to be fixed were Seville and Lima in Peru. The methods in which these positions were fixed although the account of it may be prolix is so curious and important both now and in the future that it is here given. In former years Your Majesty sent out orders to the Indies that the eclipses of the years 1577 and 1578 should be observed. Pedro Sarmiento observed near Lima on a hill called

⁹ Voy Baffin Hakl; the attempts are pp 20, 122. See also p 51 for description of measurement of the sun's parallax.

¹ Work cited p 214.

² Established Jan 20, 1503 by King Ferdinand and Queen Isabella; see *Primeras Ordenanzas para el Establecimiento y Gobierno de la Casa de la Contratacion de las Indias* p 285 v 2 Navar.

Quipaniurco in presence of the priest of the village named Gaspar de Lorca and of a good pilot and arithmetician named Sebastian Rodriguez, who assisted made notes and signed as witnesses. On that hill the eclipse ended at 8 hours and $\frac{1}{16}$ hour in the evening. This same eclipse was observed by Rodrigo Zamorano in Seville who showed me the computation. The result was that the eclipse ended at the meridian of Seville at one hour exactly after midnight x x. The difference then that is derived from the observations of Sarmiento and Zamorano is as follows:—The difference is 4 hours 56 minutes,³ which reduced to degrees gives 74° of longitude and this is the number of degrees of longitude between the meridians of Seville and Lima.”

The stated difference of times is $4\frac{15}{16}$ hours, 4 hrs 56 min 15 secs, $74^{\circ} 03' 03''$. The longitude of Lima is by modern tables $77^{\circ} 07' 36''$ and of Seville $5^{\circ} 58'$ both west from Greenwich. The difference is $71^{\circ} 09' 36''$; Sarmiento's value 74° flat is $2^{\circ} 50' 24''$ about 160 miles too great. This is one of the most note-worthy events in the history of oceanography; as to the rarity of similar attempts in 200 years following see above p 306 n 8 for list of places in the earth whose position was thus fixed in 1784.

Sarmiento continues about charts: the latitudes he says are in agreement but there are discrepancies in longitude, the greatest he mentions being 7° . He mentions 5 charts in all and on one the longitude of Lima from Seville was 71° , very nearly right. Longitudes on the 5 charts and all others of the day unless there had been some determined in the way described by Sarmiento were by ships' reckonings. The charts Sarmiento mentions were on parchment and drawn and painted by pilots. He says, “Pedro Sarmiento made the *padron* for the North and South Seas.⁴ As regards the *rhumb*-lines they had been badly ruled on the parchment by x x. Sarmiento constructed 23 charts and a *padron* which was sent to Your Majesty. By these arrangements the charts were prepared for the voyage. Astrolabes cross-staffs needles and other navigation instru-

³ Sarmiento does not say how he and Zamorano determined time. There were no mechanical time-keepers unless we call clepsydras and sand-glasses by that name; the pendulum is said to have been first used to stabilize mechanical motion in 1649 by the son of Galileo and the day of the balance-wheel was still further away. The instant of the eclipse at Seville and Lima must have been determined by an altitude of the moon or star as it was night. As has been seen this was done many centuries earlier (pp 60, 237-8 above); the circumstance was probably deemed by Sarmiento not calling for mention.

⁴ The Atlantic and Pacific; *padron* means master chart.

ments were all provided in sufficient quantity so that there might be nothing wanting in conformity with the demands of all the navigators pilots masters and captains no objection being raised.”⁵ It will not escape notice that though printing had been common for 100 years the 23 charts were made by hand; also astrolabes and other instruments of navigation were made by pilots and cosmographers. Neither here nor elsewhere does Sarmiento furnish a hint as to how the speed of ships was ascertained.

A very interesting part of the above passage is that about rhumb-lines having been ruled in the charts before Sarmiento began to work with them for it gives knowledge how charts were made which in turn shows how they were used. This has been entered on in dealing with early charts⁶ and will not be repeated here except to note when Sarmiento, the pilot cosmographer geographer whichever we are to call him, came to make the charts by plotting positions of points of land and cities the lines he used to plot by were already on the paper or parchment: so it would be today; the only difference is that in modern day the lines are at right angles and in that of Sarmiento radiating.

Thus by observation of a phenomenon occurring simultaneously at Seville and Lima the arc of longitude between them, correctly $71^{\circ} 09' 36''$, was determined in 1577 or 1578 to be 74° . There are stated longitudes of widely separated points in Herrera's work written about 1620.⁷ It is not likely all these were determined in conformity with the King's order, but some may have been. The City of Mexico Herrera gives $19^{\circ} 30'$ latitude and 103° W from Toledo in Spain; it is correctly 99° W from Toledo. Santiago de Chile is placed $34^{\circ} 15'$ S and 77° W of Toledo, being correctly 33° S and 66° W. Herrera gives also the distance in a straight line of both the City of Mexico and Santiago from Toledo;⁸ obviously measured by ships.

SHEATHING.

It has been mentioned that the underwater body of ships carried plates of metal before the Christian Era⁹ and a Spanish ship was so fitted in 1514. July 27, 1515 the King of Spain ordered ships sheathed to prevent injury by the borers common in equatorial regions; plates

⁵ Voy Gamboa p 218: the ships carried cross-staffs as well as astrolabes.

⁶ Above pp 298-99 and below 663-65.

⁷ Above pp 597-98.

⁸ Desc Indes Occid pp 23, 69 Fr ed.

⁹ Above pp 79, 225-26. It is not clear whether the entire hull or only the seams were covered.

covering only seams to prevent caulking from working out had been used before.¹ Sarmiento wrote in 1581, "During this wintering at Rio de Janeiro all the ships were attacked by worms and bored, receiving notable harm and deterioration, except those of Your Majesty which had their bottoms covered with lead."² Sheathing with metal was not generally adopted in northern countries before 1650 to 1700. John Locke an Englishman who wrote in 1704 says sheathing was in his day new and mentions it on a vessel of the Roman Emperor Trajan sunk about 100 A D in the Lake of Riccio. Being raised 1300 years later she was found to have her bottom covered with lead plates fastened by copper nails.³ Richard Hawkins extols the advantages of sheathing with copper or lead writing about 1590 but does not say English ships were sheathed.⁴

VOYAGES OF PYRARD AND LINSCHOTEN.

The voyages of Pyrard and Linschoten were fully recorded and there is much of interest as to ships and ways in them. Pyrard was French and sailed from St Malo May 18, 1601 for the East Indies there being 2 French ships in the squadron *Croissant* and *Corbin*, rated respectively 400 and 200 tons. Pyrard was in the latter and though not a seaman must have become one for he remained in India till 1610 and went more than one voyage there. His ship was wrecked in the Maldive Islands and he drifted in the East from one employment to another until 1610 when he returned home and wrote his book, returning in one of the huge trading-ships of the day, a carrack belonging to the Portuguese.⁵ Our author had long and varied experience. When the squadron sailed from St Malo in 1601 it ran through the Canary and Cape Verde Islands and made the coast of Sierra Leone in Guinea but did not communicate with land; "We had been drawn in against our will. x x This coast is very unhealthy and inclement," Pyrard writes. The pilot must have been uninformed as to sailing-routes

¹ Above p 79; p cxxx v 1 Navar; below p 644 as to practice in sheathing with metal in about 1610.

² Voy p 246.

³ Above pp 225-26; also *Whole Hist of Nav* Locke p 215. Captain Saris who commanded the first British ship that went to Japan 1618 saw there a sheathed junk, evidently to him a novelty. It is not clear whether this Roman ship of 100 A D had the entire bottom or seams only covered.

⁴ Hawkins *Voy Hakl* p 202. English ships it is said were not sheathed until 1765 when the *Alarm* 32 guns was covered with copper; *Steinitz The Ship* p 297.

⁵ *Voy Pyrard Hakl*: this is trans from an ed of 1619 in French the last published during Pyrard's life: the original is in larger libraries.

for they should have been 500 miles further west in the latitude of Sierra Leone. About when they crossed the equator Pyrard wrote, "We took the sun at the usual hour namely at mid-day which sailors call the observation; there was found to be no elevation so that we understood we were under the line.⁶ The latitude is taken with the astrolabe from the sun or from the stars by the *jacobs'-staff* called by the sailors the *arbaleste*."⁷

It is not clear where the ships were on the coast of Africa but they were there a long time and many of the crew fell sick. On August 30 104 days after sailing when they should have been far east of the Cape of Good Hope they arrived at Anabon Island, close up in the great bight in the coast of Africa, latitude $1^{\circ} 36' S$ longitude $5^{\circ} 40' E$. Here they remained 6 or 7 weeks but as the health of the ships' companies did not improve and they could not procure good food and water they sailed for St Helena, fortunately arriving in 30 days. They were much out of the proper route and the wind is generally ahead going from Anabon to St Helena. In 2 weeks the sick being recovered and food procured the ships went to sea reached the Abroilles as Pyrard calls the shoal off the coast of Brazil and turning east passed the Cape of Good Hope. The Cape is 1800 miles S S E of St Helena and the Abrolhos Shoal 2000 miles almost west but to the latter the wind was fair and dead foul to the former. Pyrard says of the Abrolhos, "These shoals are exceeding dangerous x x. This is the reason why ships going to the Indies out of care to keep them at a distance fall away too much on the other side toward Guinea x x; the dexterity of good pilots lies in not approaching too near the coast of Guinea and also in not striking these banks of the Abroilles on the Brazil side."

The pilots bungled badly. There were probably no Portuguese or Spanish charts or sailing-directions in France and the commanders of the expedition had neglected Drake's precaution of seizing these wherever possible together with pilots who understood them.⁸ Pyrard continues, "Having thus doubled these banks we had a merry-making and appointed by lot a King to rule during the feast which lasts a whole day and there was served out to each a pint of wine more than the ordinary." Games are now held at

⁶ They crossed the equator in August when the sun would be in north declination. He means no elevation of the pole, the sun was very high.

⁷ No instrument or appliance has been called by more names than this one, cross-staff fore-staff arbaleste ballestilla stadimeter etc; a proof of wide employment: it is probably the parallactic ruler of Ptolemy the Geographer and the instrument of 3 *taboas* Gama found in the hands of the Arabs when he came to the East.

⁸ St. Helena Island is $15^{\circ} 55' S$, $5^{\circ} 45' W$; the Cape of Good Hope $34^{\circ} 22' S$, $18^{\circ} 30' E$; the largest of the Abrolhos group $17^{\circ} 58' S$, $38^{\circ} 42' W$.

crossing the Line when Neptune comes onboard over the bow and shaves and bathes those crossing for the first time. Pyrard's notice of the celebration is not the earliest; Gama's squadron celebrated when they reached St Helena Bay on the coast of Africa in 1497 Linschoten notices the games when he went to India in 1583 and John Davis when he went there in a Dutch ship in 1598.⁹ Ships homeward bound from the East held games when they rounded the Cape of Good Hope and squared away for the north in the S E trade.

As the simpler course, extracts from Pyrard's work will now be given: *V 1 p 23*. Pyrard's squadron met near Madagascar ships of Holland and proceeded with them for a time. The Holland ships were bound to the Indies but were to go inside Madagascar to meet other ships of their nation while Pyrard's squadron was to pass outside; "Wherefore we parted and took leave of each other with much cannonading." Ships fired their guns on very small occasions, though thereby leaks were opened. The commander of the Holland ships deemed it well to part with the French; he said, "My men had only 3 pounds of biscuit each per week and every 10 days 2 pints of wine instead of the barrels of wine continually opened by the French where each can go and have all he wants. They have all the biscuit they want too. They throw stock-fish overboard after cooking it. A ration of wine is 6 pints a week to each man and they go beyond this x x. The example is dangerous and should not longer be under our eyes."

V 1 p 28. In a gale it is determined to cut away the Corbin's main topmast. The mast is cut half-through and then the rigging cut; the mast goes overboard and carries a man with it; he is saved by, "Encountering the great yard which being lowered and lashed cross-wise stretched out beyond the ship some 9 or 10 feet." It must have been 60 to 80 feet long; this shows that in heavy weather ships lowered the main yard and rested it on the rail; the small sails set at these times were extended by the mast.

V 1 p 51. Pyrard's ship the Corbin is wrecked on the Maldives; "Everyone was asleep that night even those on watch, the mate and second mate had been carousing and were drunk, the light usually kept on the poop for reading the compass was out because the man who held

⁹ Above p 564 as to Gama; Voy Linschoten v 1 p 16; Voy Davis p 134: both Hakl.

the tiller at the hour, who has also charge of the light and the *horloge de sable*,¹ had fallen asleep as had also the ship's-boy that attended him; it is customary for the man at the helm always to have a ship's-boy by him. xx So while we were all asleep the ship struck heavily." This reads as though the helmsman had a compass before him which was not the practice in earlier days.² Until years later a half-hour or hour sand-glass kept the time; if a sleepy boy failed to turn it or turned it too late or too soon the ship's economy was upset.

V 1 p 53. It is often said ships of these days towed their boat so she might be ready in case of disaster, but Pyrard's ship did not do this: when stranded the ship fell over on her side and he says, "We had to rig up something to carry us for we could not hope to get the boat out. We took the yards and pieces of wood x x and bound them together and nailed planks on this x x."

V 1 p 65. When he reached land Pyrard made friends with the King of one of the Maldives and writes of him, "He was a man of great honor and courtesy knowing and inquisitive. He was also a good *pilot* ³ and possessed himself of the compasses and marine charts of our ship the uses of which he often enquired of me theirs being made in another fashion."

V 1 p 66. "The King's people came day after day to take what they could from the ship chiefly the lead with which it was bottomed. This they prize highly in that country."

V 1 p 308. "I must not forget to mention that I saw in the Maldives a great eclipse of the sun at high noon, this was in the year 1605, which lasted 3 hours x x. They all carefully observed the day hour and minute of the eclipse and it was recorded in the public archives." A note refers to L'Art de Verifier les Dates Paris 1770; here this eclipse is listed as of Oct 12, 1605 and occurring very widely, no use seems to have been made of it.

V 2 pp 116-131; Chap 8: Of the Portuguese Soldiers at Goa Their Manner of Life and Taking Ship Divers Expeditions and the Order Observed by Them in War. This is all interesting; for example, "Honors and titles given by the soldiers to each other are not used until they have

¹ These are Pyrard's words in the Fr ed of 1619 published during his life: the phrase means *watch of sand*; it was a sand-glass to keep the length of time the watch was on deck, running probably $\frac{1}{2}$ -hour.

² Above p 294; below p 637 n 6.

³ This is Pyrard's word; he means what we call *navigator*.

passed the Cape of Good Hope; then they abandon all their former manners and customs and throw their spoons into the sea.⁴ As to food onboard ships in government service, "As provisions they have to take no thought on that score being well fed at the expense of the King and according to the produce of the place visited. When at sea they take the ordinary ship's victual that is rice with butter sugar lentils and mangas: this is a fruit in the form of an olive but much larger. Frequently they have biscuit too and the drink is water only. They eat also a salted fish named *pesche cavalo* along with rice. When in port they get all kinds of victuals procurable at expense of the King. Those who go ashore and care to live there do so at their own expense. Onboard each soldier has his own dish and eats by himself. x x In these vessels there are 2 kitchens one for the captain and soldiers and one for the mariners and sailors. x x The soldiers have mats and mattresses for sleeping on x x. In the morning they fold and wrap these up and lay them away. Onboard ships there is so little room that when you lie down you can hardly stretch yourself at full length." ⁵

V 2 pp 140-168. "Being then at Goa with the Portuguese I was a soldier in many of their armies equipped x x to go beyond Goa to Ceylon Malacca Sumatra Java and other islands of the Sunda and the Moluccas and was paid like the rest."

V 2 pp 180-214; Chap 14: Of the Form and Fashion of the Portuguese Ships Going to the Indies and of Their Shipments Order and Police as well Going as Returning. This is all interesting, "Carracks are all built at Lisbon by reason of the harbor there x x. They are from 1500 to 2000 tons burthen sometimes more so that they are the largest vessels in the world x x, they cannot float in less than 10 fathoms of water.⁶ There are some ships in the Indies coming from Arabia Surate and other places which approach 1000 to 1200 tons but they are not so strong as the carracks because less iron is used in their fitting x x. These are not so liable to rot or to be pierced with worms because they use no timber that has not lain 3 or 4 years and their timber is by nature harder and better than

⁴ Because no-one used spoons in India: the authority for the custom is cited.

⁵ This would be only when the ship carried many passengers. Evidently the soldiers were *idlers* as sailors would now call them; they kept no watch at night. In sailing-vessels 50 years ago the ship's-cook was the only idler and he was up from early daylight till 7 or 8 P.M.

⁶ An error; Pyrard's words are *dux brasses d'eau*.

ours.⁷ These great carracks have 4 decks or stories on each of which a man however tall can walk without touching his head against the deck above, indeed he comes not within 2 feet of it. The poop and prow are higher than the main-deck by the height of 3 or even 4 men in such wise it seems like 2 castles erected at the ends.⁸ There may be 35 or 40 pieces of bronze cannon for they hardly ever use pieces of iron as we do. Their cannon is of 4 or 5000 pounds the least of 3000. x x Their masts are lengthened by splicing and covering all around with fishes, thick pieces of timber cleverly fastened. These are lashed with ropes and well bound with iron braces so as not to impede the yard in its rise and fall. The yard is of proportionate thickness to the mast and 144 feet long:⁹ it requires full 200 persons to raise it aloft and always with 2 big capstans.¹ They cover not their ships with lead as we do ours; they only put it over the seams to keep fast the caulking. x x I have observed that the larger and heavier a ship is the more she labors. x x For the soldiers they draw upon all classes, but they get not such good mariners as they could wish, from these they get their gunners and other officers. The soldiers have 6 *perdos* a month the gunners and mariners 4 x x. The condition of a man who has no berth onboard is pitiful indeed ² x x. The seamen onboard the carracks resemble not any others I have seen. For true it is that all seamen while at sea are barbarous cruel and uncivil wretches, x x while onshore they are very angels. The mariners of the Indian carracks x x are courteous and well-mannered both at sea and onshore bearing great respect to one another.”

“As regards the order preserved by the Portuguese in these carracks during long voyages I will say first of all that the numbers are more than 1000 or 1200 or at least 800 to 900 who are ranked in the manner fol-

⁷ It results that Arabs Persians Indians and Javanese, may-hap the earliest of seafarers, built good ships in Pyrard's day; he also wrote, “A certain carrack built at Bassains which is between Goa and Cambaye made as many as 6 voyages to Portugal:” a note says her name was Chagas, built in 1561; she carried 900 passengers and a crew of 100 and lasted until 1587 having made 11 voyages to Portugal: she made a voyage from Lisbon to Cochin without touching in 7 months.

⁸ The castles rose he says 15 to 20 feet above the ship's principal and upper deck, more than half way to the main yard.

⁹ Longer than the main-yard of the *Pennsylvania*, the largest sailing ship-of-the-line built in this country: Pyrard wrote the mast was *vingt-quatre brasses de long*.

¹ This in Pyrard's text is *capestan*. Ships lowered lower yards at sea; Pyrard's had hers down in a gale (see above, p 632): see *Jal Glos Naut* words *papafico papahigo pacfi*; these are names applied to the lower sail; their origin is thought to be the small storm-sails set when the main-yard was down.

² This must refer to passengers; sailing vessels had room for the crew.

lowing: There is a captain who is absolute over the whole ship and the men onboard, next there is a pilot second pilot master master's-mate guardian 2 rope-makers some 60 mariners 70 or more apprentices and a master-gunner who they call the *constable* assisted by 25 other gunners more or less. He gives orders to all below the captain x x. Besides these there is a clerk who is all-powerful being appointed by the King. Nothing is carried on behalf of the King or private merchants he does not take note of. x x He has vast authority in the ship and nothing takes place ere he has first given his advice and consent. x x The captain has command over all both the crew and the passengers and for all they may be greater lords than he they must obey him. Nevertheless when something of importance has to be done he takes advice and counsel of all the officers gentlemen and merchants and makes them all sign in case of future enquiry. He cannot condemn to death for crime but may give the *estrapade* in the vessel and other corporal punishments and hang by under-the-arms. For the *ciuil* he may condemn to 200 *croisades*³ without appeal. He may keep a man imprisoned with irons on his feet all the voyage and on reaching land turn him over to justice."

"After the captain the pilot is the second person in the ship for the master obeys him and does only as he orders. He never leaves his place on the poop ever observing the needle and compass, he has a second pilot to help him. The master is after him and commands the seamen ordinary seamen and others who work the vessel⁴ he has a mate under him to help him, these are all appointed by the King. The master's duty is to command from the poop to the main-mast x x. The master's-mate takes charge from the forecastle to the foremast inclusive of that mast and has the same duties there as the master on the poop x x. Each of these remains night and day on his own quarter and it will happen that in 6 months they visit not each other 4 times. The mariners are highly respected and there are few of them but can read and write such being very needful to them for the art of navigation. For by this word mariner is to be understood one who is well instructed in navigation, but yet there are few good at it although all bear the name. Theirs is the work of steering the ship each in his turn. In these great ships x x they take 1 or 2 ordinary seamen to

³ Neither *ciuil* nor *croisade* is in French or Spanish dictionaries accessible; the last was possibly flogging by right- and left-handed men who would cross their blows. Pyrard says the captain could not condemn to death but 200 blows would be fatal.

⁴ Pyrard has *mariniers gourmetes et autres gens de travail du navire*.

their aid. They do all the work that has to be done aloft such as setting and reefing the sails. They never clean the ship nor work the pumps save when necessity requires. The guardian may not command them in anything.⁵ They are divided into 3 watches for the night, the pilot has one watch the master another and the master's-mate the third. In like manner the apprentices are on watch with them. Each party is on watch 4 hours and each man is 2 hours at the helm. It must be noted that in these large ships there must be 3 compasses; the pilot that is high up on the poop has one, under the deck there is another for the mariner who is there to hear the pilot, because he that is below at the helm could not hear him; so the one that is betwixt passes on to him the pilot's word."⁶

"There are 2 principal mariners they call *trinqueres* that have care of the ropes and sails and mend these. There are also 4 little boys x x who serve to call the whole company to their duty, they sing out from the foot of the mainmast and even then all can hardly hear them. x x There is a sergeant to execute the commands of the captain in matters of justice; the prisons are at the foot of the pump; there they place the malefactors most often with irons on their feet x x. There are also other smaller prisons x x where are blocks of wood pierced with holes whereinto they put the criminals' feet which are then fastened with padlocks. x x The sergeant has also charge of the fires x x. For this purpose there are on the 2 sides of the ship at the main-mast 2 large kitchens; when the sergeant lights the fire there which is close upon 8 or 9 o'clock there are always 2 guards present one at each kitchen x x. Also he has the duty of seeing the fires put out which is at about 4 o'clock. In these vessels are also many artisans, x x surgeons carpenters caulkers coopers etc; all the ship's officers have each his own station. Some are allotted to sleep always aloft in the top and the rest each at his hatch except the 4 that sleep in the top. x x The master mate guardian and master-gunner have each a big silver whistle wherewith they make known all their orders. x x There are also in the ship great numbers of soldiers gentlemen merchants

⁵ The guardian's office was military.

⁶ The rudder-stock reached to the lowest of the 3 decks in the stern-castle; here was the tiller and helmsman with a compass before him; on the deck next above was a mariner with a compass before him to pass the pilot's orders to the helmsman and on the highest deck the pilot also with a compass. Pyrard says there were 3 compasses, so the man at the helm had one. The compasses had *lubber's-marks*, vertical lines painted on the stationary box in which they are placed, and were in essentials the same as those now used; see above p 270. This is I think the earliest mention of a compass placed in sight of the helmsman; its date is 1600.

ecclesiastics and other passengers of whom I say no more having no concern with them here."

"When these great vessels are ready to start the King furnishes them with all sorts of provisions which are for the common use from Portugal to Goa and no further. The steward for the soldiers gives them their commons first then the steward for the mariners and the other officers and seamen serves out theirs, so all without exception get their ordinary day by day; 1½ pints of wine the same of water and bread as much as they can eat. As for other things; salted meat 30 pounds per month; everything else is given in the same proportion such as oil vinegar salt onions and fish. These are served out for a whole month except the wine and water, which is for the day only and all in presence of the clerk who puts everything down in his accounts with the names. x x The evil I find in all this is that the provisions are given to them raw and each man has to cook his own victuals so that you will sometimes see more than 80 or 100 pots on the fire at the same time and when some are done others are put on. So when any are sick x x they are exceedingly ill-fed and cared-for and many die from this cause. The French and Hollanders have not the same practice for they have 1 cook for all and eat 6 off a dish x x. What is over of all provisions and ship's utensils goes to the superintendents of ships at Goa and when the ships are about to return they are furnished afresh at the expense of the King. The whole of the utensils are delivered over to the master and the provisions and goods to the clerk."

"The soldiers while onboard have to keep a guard every night but are not liable to any other work. x x The captain pilot master and other men in command, the King gives them each a berth in the ship and in like manner to the mariners. The soldiers apprentices mariners artizans and others are all paid alike; that is for the voyage from Portugal to Goa 50 *cruzados* each. The cruzado is worth 50 *sols*. x x Certain berths are readily sold at 300 cruzados wherewith they buy some goods the which the King permits them to stow in the hold, for the King retains to himself 2 decks only in each vessel there being 4 in all not counting the poop and fore-castle which are equal to one and a half. x x They can make a profit of 5 to 1 on goods in the ship. The soldiers are lodged under cover below the main-deck and the apprentices above in the open and the same with the Jesuits and other clergy when there are any; saving the ship's chaplain who has his berth as one of the officers. These ships are mighty foul and stink withal; the most not troubling themselves to go on deck for their

necessities which is in part the cause that so many die. The Spaniards French and Italians do the same but the English and Hollanders are exceedingly scrupulous and cleanly. As for berths a man that is without one is greatly pinched and pressed for he will find no place to sleep under cover except he pays for one for a while. And so to put away his victuals and goods he must buy a place of some-one x x so everyone is obliged to buy a place from the ship's folk. x x As regards the Catholic religion it is observed on ship-board as on land; saving the Consecration which is strictly forbidden at sea. But all other ceremonies are observed, such as mass vespers holy-water and processions, also Lent and the usual holy-days. x x As for ordinary prayers every evening at 9 o'clock the master with his whistle summons everyone to say a Pater and an Ave. Then he gives another whistle to call all the seamen to keep their watch and ward and all betake themselves to their several posts. At break of day all the ship's-boys chant a sea-orison or prayer which is for all sorts and conditions of men onboard. x x This prayer lasts a full hour, it is said in a loud voice."

"These ships thus equipped and ordered depart from Lisbon at the end of February or at latest beginning of March. They must not touch short of the Cape of Good Hope except in case of urgent need. If some accident prevents them doubling the Abrolles or passing the Cape they are forced to stand about for Portugal again and so lose their voyage. x x When they safely pass the Cape they have no place to land at and refresh themselves except at Mozambique and thither they go but in the direst extremity, so their orders are. x x While I was at Goa I saw some ships arrive there in which of the 1000 or 1200 that were in them at their setting out from Lisbon there were left not 200 and well-nigh all these sick of the scurvy which wears them in such sort that after they are arrived they hardly recover."

"The navigation of these Portuguese ships is carried on with exceeding bad order for although they sail out from Portugal all together and in convoy and are expressly enjoined not to lose sight of one another yet do they observe this order mighty ill. x x The cause of that is that all these captains are gentlemen of good houses and are unwilling to yield in aught to one another. So each goes his own way; x x then being alone they come up with some Hollander ships or other enemies that attack and take them seeing that they make but little resistance, the soldiers being only a mob of men mostly taken perforce from among the

villagers and poor artizans Also the captains have no great zeal to defend themselves; x x it is only the King of Spain and some merchants present and absent that lose by it. When these ships are captured or lost they make among them an attestation of the loss of their goods and of the office each held in the ship and when they reach home are recompensed for all, sometimes double. I must also note in passing as I have said before that all these soldiers and seamen after they have passed the Cape give themselves titles of nobility, otherwise they would be greatly blamed and despised by other Portuguese residing in the Indies. x x Be it noted that in all these voyages it is only the poor soldiers and seamen that have a bad time of it and suffer poverty because most often they do not get their wages and pay. I have sometimes seen them be 4 whole months without touching a *sol* and all the time the King is paying. So it may be seen the Indies are good and profitable only to the viceroys governors and some of the King's officers not to the King nor to the poor soldiers and mariners."

V 2 p 202, Chap 15. Of the Traffic of the Portuguese Throughout the Indies in General and the Order Which They Observe Therein: P 272; "Four great carracks arrived at Goa each of 2000 tons burthen or thereabout x x. Five had left Lisbon but they had lost sight of the 5th in a storm at the Cape of Good Hope. Each carrack had onboard upwards of 1000 men including soldiers sailors Jesuits and other clergy merchants and gentlemen, and when they arrived at Goa they had but 300 in each and half of these were sick by reason of the great calms and great fatigue and want of fresh water they endured at sea; for they were 8 months without touching land."

P 273. Pyrard wishes to return home from Goa; several Portuguese captains wanted him to go with them to China Japan Mozambique or Sofala; finally, "We 3 Frenchmen were taken before the viceroy who was greatly astonished to hear who we were seeing that no French ships had hitherto come to the East Indies, but seeing the plight we were in and the long time we had spent there he promised to give us leave to go and victuals for the coming voyage. For 4 months the carracks were being refitted during which time an armada of galiots was sent to convoy 10 ships to Cananor Bacalor Barcelor and Onor on the Malabar Coast to the south of Goa in order to bring pepper for a cargo for the carracks. x x When the ships were loaded we had our license from the viceroy, but he gave us no provisions saving only he put in our passport an order to let us embark with our clothes and *matelotage*, which is the food that every-

one takes with him, and to give us the regular commons of biscuit and water as they give to the sailors. For as I said before the King supplies all commodities on the outward voyage but on the homeward none except to the ship's officers and then only biscuit for the whole voyage—though in fact not enough for 3 months—and nothing else. x x If he should supply provisions for the homeward voyage x x many of those who are now constrained to remain in India would return.”

Pp. 277–283. At the time he left Goa for home 4 carracks started; the first sailed Dec 26, 1609 and the last onboard which was Pyrard Feb 3, 1610. They were to wait for each other at St Helena and go home from there in company for better security against enemies.

P 283. “We went onboard by night on account of the tide. x x It is a marvel to embark in one of these ships that seem like castles with the vast number of people onboard and the amount of merchandize they carry. Ours was so laden with goods on the deck that they reached almost half-way up the mast and outside on the chain-wales which are ledges on each side you saw nothing but merchandize provisions and bunks, which are the little cabins wherein the mariners and others lie covering them over with fresh ox and cow hides. x x. In our vessel were about 800 persons including the slaves and about 60 Portuguese and Indian women.” He had bad fortune about food and water; the ship reached Bahia in Brazil in sinking condition with food and water exhausted in about 6 months; of this he writes;

P 286. “We got water so long as it lasted like the officers and mariners of the ship and so with biscuit but at the end of 3 months the pittance failed. Sometimes the voyage lasts 8 or 9 months more or less. Thus did we suffer many hardships in this voyage from Goa to the Bay of All Saints which took us about 6 months. At times but rarely some good man bade us to eat with him or sent us something. But a greater rarity was drink which they gave us very seldom and then it was a little *eau de vie* or raisin wine.”

A summary of the homeward voyage is as follows: the ship sailed from Goa Feb 3, 1610, sighted the island Rodrigues Mch 15, Cape of Good Hope Apr 8 and doubled it May 31; anchored at St Helena June 25; sailed from St Helena for Bahia July 14, reaching the last in sinking condition Aug 8. Here the vessel was abandoned.

P 290. Before reaching the Cape, "All the cannon as also the boat were taken below and the ship girt with cables in 3 places, the poop amidship and the bow."⁷

P 292. When off the Cape, "During a gale there fell out a great quarrel, for it being resolved to throw overboard all boxes baggage and goods that were on deck x x there arose such an uproar and mutiny among the ship's company that they came to blows with their cutlasses and the captain was at length constrained to lay many by the heels and put them in irons. This storm lasted well nigh 2 whole months; x x thus we remained until the end of May unable to make headway against the heavy gales and contrary winds. The cause of this misfortune was that we were too late in leaving Goa x x. The ship was so shattered by the sea and leaked in such sort that for the remainder of the voyage we could not leave the 2 pumps night or day. And even so the sea came in in such quantity that we could not manage to empty her with the buckets, though every one even the captain worked."

P 295. "On the last day of May 1610 we doubled the Cape. On the morrow finding we had passed it we indulged the hope of reaching Portugal and returning to India no more for on the return voyage none entertain this hope till they have passed the Cape, ever expecting to be obliged to retrace their way and in like manner do those from Portugal to the Indies. On that day in token of our rejoicing we sang a mass and a Te Deum x x. And on the Sunday following was represented a very pretty comedy that had been got ready and rehearsed during the voyage from Goa to the Cape to be played when we passed it; thus had we good entertainment for 3 days after passing the Cape. x x About June 5 a council was assembled to determine whether we ought to make straight for Portugal, that is if we had fresh water enough and if our ship was fit for the voyage or whether we should go to St Helena or the Kingdom of Angola in Africa for refreshment. At length after much discussion it was resolved to make land at St Helena for refreshment and for refitting the ship, that island was the nearest land and the wind was fair for it x x. Another

⁷ Girting-in ships or swiftering them in was common and lasted long: St Paul's ship *used helps undergirding the ship*; it is shown in the illustrations of DeBry of about 1600; and is mentioned in the day of the famous British admiral Lord Hawke about 1760. The girtings mentioned by Pyrard were at right angles to the ship's length but hawsers were sometimes carried around the length. They were hove and wedged as tight as possible; their use gives vivid idea of how ships worked in a sea-way. Note here the cannon and *the boat* were taken *below*: to lower weights.

reason was it lay in our way while Angola did not. x x A fear arising lest we should meet Hollanders at this island all cannon that had been put below were remounted and the ship put in order for fighting. We had in all 40 pieces of heavy iron cannon."

P 303. The ship anchored in St Helena bay with two anchors placed far apart and with cables hove taught to keep her in one position as ships now anchor where there is not room to swing at single anchor; as they were getting underway to leave St Helena, "We had weighed our anchor at the shore end and were about to weigh that toward the sea x x." The ship went onshore while weighing and was got off by staving the casks lately filled with fresh water and by anchors carried to seaward. She was much injured, "The ship was making much more water than usual x x and we had no fresh water nor casks to obtain it withal. Hereupon a council being assembled it was settled we should discharge the ship on the island and make a pinnace x x to go to the Bay of All Saints x x. But at a subsequent council it was resolved to venture to reach the Bay of All Saints which is the capital town of Brazil and where the Portuguese viceroy resides, a distance of 550 leagues."⁸ Before sailing it was discovered the rudder was damaged, 6 of the 9 hinges and bolts by which it was held to the ship being broken, it was unshipped by the capstans and new bolts affixed by divers.

The ship sailed from St Helena July 14 and anchored off Bahia to await a pilot to take her in August 9; 31 days in making 2000 miles about 64 miles per day. She had the S E trade on the port quarter or astern but it may have been light. Pyrard says of the passage, "We never left the pumps the whole time so shattered and leaky was our vessel." On arrival at Bahia he writes, "It was now 6 months since we left Goa and we were accordingly utterly exhausted with the labors of the sea. There remained of our company about 550 persons men and women whereof the most part were sick." It will be remembered there were 800 and 60 Portuguese and Indian women at starting.⁹

In Bahia the ship again went aground though she had 2 pilots of the country onboard and after this made water so fast there was nothing to do but beach and abandon her. A small vessel was sent to Lisbon with the report she was at Bahia and vessels came out to bring the cargo and

⁸ Bahia and St Helena are in latitude 15° to 17°; the former 39° 30' and the latter 5° 45' W. The distance between them is 2000 miles; thus Pyrard's league is 3.6 miles.

⁹ Above p 641: they lost 310 in 180 days.

people home. Pyrard sailed in a Dunkirk-built ship rated 250 tons Oct 7, 1610; he and 2 French companions, "Offering to go as the other sailors but without wages considering ourselves lucky to be able to work our passage." The vessel had 60 persons onboard many being passengers was loaded with sugar and, "Equipped with cannon and all other provision of arms and munitions." After many adventures including a quarrel between the captain and a Jewish merchant onboard who had great stake in the ship which ended by the merchant, "Taking the helm himself and bringing her round before the wind," the vessel reached Lisbon Jan 15 1611.

Thus was Pyrard returned. After performing vows made during gales he, "Met with many merchants of my native place which is the town of Laval in Brittany and thither I returned with them the 16th day of February in the year 1611 for which God be praised." To Pyrard's Voyage is appended A Treatise and Description of the Animals Trees and Fruits of the East Indies Observed by the Author in which are the following allusions to things of the sea:

Pp 387-403. Advice To Those Who Would Undertake the Voyage to the East Indies.

P 388. "I have not found it of use to sheath the ship with lead as ours was ¹ for although this may be good against worms x x yet for all that it clogs the vessel too much. The Portuguese use it only at the seams and joinings of the timbers. For this purpose tin would seem to me the most suitable."

Pp 390-2. The scurvy; "It is especially necessary before setting out to make provision of orange and lemon juice." These were used until 200 years later.

Pp 393-98. Regarding officers in ships and their duties he says, "I must not forget to say that when ships are sailing in company or meet one another at sea and are yet afar off and those onboard cannot speak by word of mouth the default may be supplied on both sides by the use of trumpets whereby intelligence may be given as well as by the voice. This is observed only in the ships of the French English and Hollanders." ²

¹ The French ship Corbin in which he went out was sheathed.

² Wind instruments were the first musical instruments; there are mentions of them as signals of battle in the Bible some of great antiquity. Alexander the Great it is said had a horn by which to assemble his army from great distance: there is little doubt in the day of Pyrard speaking-trumpets were rare or non-existent; see Beckmann Hist Inventions Speaking Trumpet.

Also there is a narration of a quarrel between the captain of a ship and, "The Chief merchant" which ends by the captain, "Ordering the chain to be fetched, x x When the chain was brought he gave order the merchant should be chained by the feet to the main-mast which is the usual place for chaining misdemeanants." The merchant ran to find his arms and seems to have escaped the chain.

LINSCHOTEN'S VOYAGE.

The voyage of Linschoten to the Indies in 1583 corroborates Pyrrard.³ The allusions to sea affairs will be given in the same way as with Pyrrard:

V 1 p 15. He writes of the trade-wind, "The general wind which bloweth all the year through."

P 18. When bound out the ship kept close to South America as far as the River Plate 35° S; "Here we got before the wind to the Cape of Bona Speranza."

P 33. From Sofala on the coast of Africa, "They sail thence into India but once every year in the month of August till half-September because that through the whole countries of India they must sail with *monssoyns* that is with the tides of the year which blow certain months in the year. x x In the month of April the wind cometh again to serve them for Mozambique so that every year there goeth and returneth one ship."

P 40. They reached Goa Sept 21, 1583 166 days from Lisbon having lain 15 days at Mozambique; "One of the speediest voyages in many years before or since," Linschoten writes; but this is unlikely for they came too near the coast of Guinea and were becalmed there: our author writes, "x x To shun the calms and storms near the Guinea coast and not to hold too far off to pass the flats and shallows of the Abrashos wherein consisteth the whole Indian voyage."

V 2 p 231. Description of the duties and quarters of officers.

Pp 268-9. When his ship was near the Azores she was attacked by an English vessel: the account of the fighting will be found above p 524.

BETTERMENTS IN SHIPS AND MASTING.

The high structures at bow and stern were living quarters of crew officers and passengers and were used as *close-fights* for the men to retire to if an enemy gained the deck. They were highest in vessels built in Por-

³ Voy Linschoten Hakl.

tugal and Spain to go the long voyage to the Indies and were not on those of Dias Columbus or Magellan. Sir Walter Raleigh wrote about 1600, "The high charging of great ships brings many bad qualities; $2\frac{1}{2}$ decks is enough and no building at-all above that but a low captain's cabin."⁵ Pyrard who wrote 30 years later says Portuguese carracks have 4 decks and castles at bow and stern rising 20 to 30 feet higher than the main deck. Raleigh says in the same place that fidded topmasts capable of being lowered are coming in and topgallant sails but nothing of royals or triangular sails set as jibs and on stays between masts. These came about 100 years after Raleigh's day but in his time triangular jibs were carried by small vessels.⁶ In 1681 a government commission sat in Paris to consider and improve ship-building; Duquesne who commanded the French in the battle in which Ruiter was killed was a member, and soon after Pere Hoste wrote his *Theorie de la Construction des Vaisseaux*, usually bound with his *Art des Armées Navales*. These 2 works are perhaps the earliest modern treatises on their respective subjects; the ancients understood scientific ship-construction and made calculations resembling those made today and there are no treatises regarding war more clear and full of suggestion than the works of Herodotus and Thucydides. Some lesser things used now are old; we have lately come on the speaking-trumpet onboard a ship in 1605 and vanes to show the direction of the wind were used in Athens in pre-Christian day.⁷

BILGE PUMPS.

There were few things in ships of mediæval day barring the main-mast more important than bilge pumps. Archimedes invented the endless screw said to have been used to pump out ships about 200 B C⁸ but pumps used until the Great Ocean Voyages were very crude. Small craft passed water up in buckets even when the height required it passed by several men and pumps were very poor and of wood. Diego Ribero a versatile person appointed cosmographer and master of making charts astrolabes and other instruments by the Spanish King June 10, 1523 built a metal pump. It was successful but Ribero died before receiv-

⁵ Remains Raleigh 1661 pp 251-5: Raleigh was executed 1618.

⁶ Below p 659.

⁷ The Tower of the Winds built 100 B C and still existing carried them; see Cajori Hist Physics p 9 as to vanes.

⁸ Cajori Hist Physics p 5: above p 80 for earliest record of a bilge pump.

ing a reward the King had promised.⁹ Raleigh says as to pumps, "The chain pump which bringeth up twice as much water as the ordinary."¹

TELESCOPES BAROMETERS ANGLE-MEASURERS TIME-KEEPERS.

The earliest mention of a telescope in a ship is in 1532 in which year the English ship *Vyenroyd* was furnished the following articles;² "A pompe with 3 boxys and 3 pump stavys, 3 compasses, a *Kennyng glass*, a great boat with a davyd and a shyver of brass, a snatchepolly, 4 boyeropys, a fyd of yeron." John Saris who commanded the English ship *Clove* in Japan in 1611 gave the Emperor, "One prospective glasse cast in silver-gilt,"³ and Thomas Herriot who went to Virginia in 1585 as a surveyor had a perspective glass and in 1610 made one that magnified 50 times.⁴ Friar Bacon who died 1292 is said to have had or imagined an apparatus that would show distant objects not visible to the eye.⁵ There are other mentions of telescopes in early days but none I think as early as the inventory of the *Vyenroyd* and few as early as that of Captain Saris.⁶ They soon became universal at sea; Fournier who wrote his *Hydrographie* about 1650 says no captain should go to sea without several *lunette d'approche*.⁷ It will not be overlooked that when telescopes were first made it was only the combination of lenses that was novel: the curved lense is very old; Archimedes burned Roman ships with them in the siege of Syracuse 215 B C, and there is given above⁸ ground for believing one made about 700 B C was found in Mesopotamia and an assertion that Pythagoras made a telescope 500 B C.

⁹ Navar v 1 pp cxxiv, cxxv.

¹ Excellent Obs xx Raleigh p 16. See above p 4 n 4 as to Raleigh.

² Jal Arch Nav p 278 v 2: Jal takes the list from Chronicle of England Strutt 2 vs 1779.

³ Voy Saris Hakl p 113. Saris' wife was Anne Meigs: she died 1623 and was buried in the parish-church of St Botolph, Thames St, London, burned in the great fire and never restored.

⁴ Cajori Hist Physics p 39 and note p 37.

⁵ Monthly Mag or Brit Register v 13 pt 1 Jan-June 1802 p 449. There are few things not said to have been imagined at least by Bacon.

⁶ Steinitz p 207 The Ship says Janssen a spectacle-maker in Middlebourg made a telescope in 1590; Cajori Hist Physics p 37 says Lippershey improved them 1608 and p 40 that Galileo made and used one of considerable power in 1620.

⁷ P 489 ed 1667.

⁸ Above p 60 n 3 and pp 154-5 as to siege of Syracuse.

BAROMETERS.

The pump led to these. When it was found a pump will raise water about 32 feet it was suggested pressure of the air held the water up and this was confirmed by noting a column of mercury or water varied in length as the weather varied and when carried up hills or down wells. In this way Torricelli a pupil of Galileo made a barometer in 1590. Barometers aid in predicting weather but their introduction made little noise and I have been unable to find mention of them until the day of Cook who gives the barometer for each day during his voyages, 1772-1775.

ANGLE-MEASURERS.

The astrolabe lived longer than any other instrument; our earliest written record of it is of 300 B C and the astrolabe lost by Champlain 2000 years later is of the form of the original one. Fournier wrote 50 years after Champlain's day,⁹ "It is impossible to find a better instrument at sea for the astrolabes pilots use differ greatly from those used by mathematicians," and Biot a French mathematician who died 100 years after Fournier's day says,¹ "The most common instrument for taking altitudes at sea is the astrolabe which consists of xx." Yet astrolabes like quadrants had at sea an ineradicable fault: they depended on gravity to hold them vertical and there is no fixed point on a ship. Pilots of Columbus' day knew this and estimated the error to which it led.² The astrolabe Champlain had is without the curves engraved on many. These were used for graphic solution of problems, a necessary thing when computations were laborious. How those using such instruments as Champlain's computed does not appear; probably they had the curves on a separate plate or sheet for our way was little used and logarithms which much abridge the labor of computations unused.

For centuries during the period of the astrolabe the fore-staff was available. The observer holds it on the horizon and thus it does not depend on hanging up and down. It came to be used during the Great Voyages and yet 250 years later Biot writes that astrolabes are the best instruments for taking altitudes at sea. John Davis the English sailor is the great figure in the history of instruments at sea for his back-staff was a greater invention than the instruments now universal. He understood

⁹ Hydr ed 1667 p 369: p 62 as to Champlain's astrolabe.

¹ Cons and Prin Uses Math Instr trans Stone 1758 p 201. Biot died 1733.

² Above p 331.

too the advantage of reflecting a ray of light before it comes to a scale of degrees, "Enlarging the degrees contained in the astrolabe" he called this.³

Angle-measuring instruments are now better than in the day of Davis principally because made of metal and better fitted and joined than when of wood. The modern sextant is called Hadley's, his paper regarding such instruments having been published 1731. Hooke is said to have had the idea of double reflection in 1664 but his instrument which appeared about 1730 employed one only; Thomas Godfrey of Philadelphia produced at about the same time as Hadley and Hooke an instrument of similar construction.⁴ With modern instruments and the accurate values in almanachs a skilful observer can place a ship within a mile in favorable weather and a few miles in rough or hazy weather.

TIME-KEEPERS.

Time-keepers that keep time accurately for long period are vital in high-sea navigation though lately superseded to some extent by signals by radio. The time-keepers or chronometers on which a ship relies must be very fine instruments for if they gain or lose 4 seconds it throws the longitude out a mile unless the navigator knows the *rate*, the amount by which they run fast or slow and the instruments hold this rate in spite of changes of temperature and moistness of air and shocks. Several thousand years before the Christian Era the number of days in a year was correctly determined; Hipparchus did some wonderful things regarding time in 150 B C⁵ and about 300 years later Ptolemy determined the hour by an accurate means always available onshore or at sea; the altitude of a heavenly body. It was in about 1720 that clocks or watches became accurate enough to use in astronomical work though still not to carry time for months or years; the one thing necessary to find longitude at sea.

John Harrison, the story is long and it will be best to come at once to its end, was born in Yorkshire England in 1693 the son of a joiner. He died 1776 having lived long enough to receive the reward offered by the British government for a time-piece capable of determining longitude at sea. After many experiments his watch was carried to Lisbon in 1736

³ Above pp 343-45 as to Davis; also Revue Maritime July 1921 Evolution des Meth et Instr Navigation.

⁴ Montucla Hist Math v 3 pp 522-24: Const and Uses Math Instr Biot trans Stone 1758; p 201 for early instr and 268 for modern ones.

⁵ Above p 66.

and found capable of keeping reckoning within $1^{\circ} 30'$. For this the board of longitude gave him £500 to proceed with the work. Then his son William went to Jamaica with a chronometer in 1761; on his return in 5 months the error was 1 m 05 secs; 18 miles. The limit set by Act of Parliament was 30 miles but only half the reward of £10000 was paid. Another voyage to the West Indies was made in 1764; they were gone 156 days and the chronometer proved materially more accurate than the limit set. The board unanimously decided Harrison had exceeded all expectations and awarded him an advance of £5000 on condition he explain the construction of his time-keeper. The final payment was not made until 1769.⁶

The time-keepers with which Harrison won the award are in Greenwich Observatory but the devices used are not now employed. The steps by which time-keepers reached their present state may be passed over with mention of interesting points. Vitruvius wrote of mechanical time-keepers in about 25 B C but the machines he describes as well as the older gnomons sand-glasses and clepsydras could not keep time accurately enough for longitudinal determination. Clocks of a kind were not uncommon in early days: Beckman in his *History of Inventions*⁷ tells of one described thus by an author of the 3d century A D, "I have a glass chamber in which the whole learning and science of the stars is constructed mechanically;" and another about 200 years later, "I am known to have constructed for you a time-piece which the light of the sun indexes; moreover another acting by water which marks the hours both day and night as frequently upon some days there is no sunshine:" the first was perhaps to study the motions of heavenly bodies like an armillary sphere and the last a water-clock. Water-clocks were used earlier than the 5th century; Æneas the Tactician 360 B C describes them and how to regulate them and Cæsar when in Britain in 54 B C, "By accurate measurements with water perceived the nights to be shorter there than on the continent."⁸ The water-clocks or clepsy-

⁶ Britten *Old Clocks and Watches* pp 215-21. See Steinitz *The Ship* p 297 for certificate signed John Lindsay comdg Brit ship *Tartar* dated April 19, 1761 as to accuracy of chron Harrison had in his ship. Steinitz continues in place cited that £1000 was advanced at the same date to mathematicians for work in preparing tables making it possible to determine longitude by observing the position of heavenly bodies;—by *lunars*. Closely at the same time chronometers and lunars became available for longitude; see below p 653.

⁷ Pp. 341-2 v 1: see p 357 for a watch that belonged to Robert Bruce King of Scotland who died 1828; it was not larger than our watches.

⁸ Above p 54.

dras described by Æneas were used to keep the ordinary time of day in encampments⁹ and Cæsar was fixing the latitude of Britain.¹ It should be noted that these instruments were portable. A very celebrated clock is the one sent by Haroun-al-Raschid Caliph at Baghdad to Charlemagne about 807: by it, "The 12 hours were marked by the performance of a cymbal and of certain horsemen who at each hour went out through the windows."²

Time could not be accurately measured by these instruments and until the adoption of the pendulum and balance-wheel in clocks and watches there was no way of controlling mechanism. It is said Bernard Walther was the first to use for astronomical purposes a clock driven by weights: he states that Jan 16, 1484 observing the rising of Mercury he attached the weight to his clock which had an hour-wheel with 56 teeth. At sun-rise 1 hour and 35 teeth had passed; so the interval was 1 hour and 37 minutes.³ We are not told how the motion of Walther's clock was controlled but it may probably have been by a revolving fly-wheel which in the same conditions will cause a driven mechanism to move at uniform speed. Galileo noticed about 1582 that the lamps suspended from the roof in the cathedral at Pisa swung in the same time, using his pulse-beats to determine this, and in 1649 his son built a time-piece employing a pendulum.⁴ A clock-maker of Nuremberg, Heulein or Hele, drove a time-piece by a coiled steel ribbon about 1500 and in 1673 Huyghens described how by a spring and balance-wheel the motion of watches could be controlled.⁵ In 1664 2 clocks made by Huyghens were sent to sea. They were driven by a spring and controlled by a pendulum and are said to have

⁹ This was kept in ships by hour or half-hour glasses until 1750-1800.

¹ The last case of the employment of this method so far as I am aware was about 1291 A D; see Yule's *Cathay* v 1 p 211. It is strange it should be employed after the method by altitude of the pole star sun or planet was commonly used: its want of delicacy may be shown by a table: on the longest day in the year,

in lat 55° the diff in length of day for 1° change in lat is	12 min,
in lat 45° the diff in length of day for 1° change in lat is	8 min,
in lat 35° the diff in length of day for 1° change in lat is	6 min.

When it is considered how indeterminate the time of the sun's rising and setting is because of refraction, it will be apparent the method is far from accurate.

² Beckmann *Hist Inv* p 343.

³ Article Time *Enc Brit* 11th ed.

⁴ Britten *Old Clocks and Watches* p 338; a model of his apparatus is at S Kensington Museum, London.

⁵ Work cited note preceding pp 57, 200 for dates. Wm Barentz when he went to the Arctic in 1594 carried a time piece driven by a coiled band; it was discovered in 1876 having lain there 280 years; see Barentz Relics *Disc Summer 1876 De Jonge*.

given good results ⁶ but led to no improvement; clocks were not to be used till 100 years had passed. Huyghens becoming convinced pendulums could not be made to swing uniformly in a ship constructed in 1674 a marine time-keeper driven by a spring and controlled by a balance-wheel; there appears no record of the performance of this, so like our time-keepers.⁷

Harrison's watch of 1764 proved it was possible to carry in a ship the time at home. When the navigator finds by observation the time where his ship is the difference between this and the face of the chronometer is the longitude the ship has crossed since leaving home. About when time-keepers became accurate shadow-instruments are heard of finally. Astro-labes and the ages-old gnomon died hard, for they were held in esteem later than 1769, the year in which the board made final payment to John Harrison; for in 1776 was repaired and restored a famous gnomon at Boulogne, in 1779 was published a work on the construction of the instruments, and in 1774 an exhaustive Treatise on Gnomonics had a 2d edition. The world today depends as always on the heavenly bodies to keep time.

LONGITUDE BY THE MOON.

The moon because of its rapid motion was long looked to as a means of finding longitude. It moves about 12° each day, about 1° in 2 hours, 1 minute of arc in 2 minutes of time, as measured from the sun, but its motion is variable being affected by other bodies and until about 1760 its position at future times could not be predicted and written in almanachs to be carried by ships. The moon is like the hand of a clock in the heavens; the position of the hand as it will appear at home is written in the nautical almanach for years in advance; the navigator by an observation reads the hand from his ship which since he is away from home differs from the home reading. From the difference it is possible to compute the longitude between the home meridian and that through the ship. In 1765 the British government doubting the possibility of making a clock that would serve, though in the previous year Harrison's chronometer had been deemed to have exceeded all expectation, advanced £1000 and appointed astronomers to compute tables of the moon's motion.⁸ Tables of this character had been published by the English astronomer Halley in 1749 and to the

⁶ P 310 Const and Prin Uses Math Instr Biot trans Stone 1758.

⁷ Britten Old Watches p 202.

⁸ Steinitz The Ship p 297: n 6 p 650 above.

formulæ by which these had been computed corrections were added and in 1767 dependable tables were published. From that year the British Nautical Almanach giving position of the moon and other bodies for several years in advance has been published.

Thus about 1770 it first became possible to find longitude at sea otherwise than by dead-reckoning, 2 ways appearing simultaneously, by chronometer and lunar distance. At first chronometers were less trusted than lunar distances as we shall see in the voyages of Captain Cook. There were in 1770 very few places of which the longitude had been determined and the dependence of a ship on her observations was absolute; unless her chronometers ran well she was at a loss. It was of no use to land to enquire the longitude and lunars being free from such objection were much used. Captain Cook whose voyages extended from 1768 to 1779 began by mistrusting chronometers and ended by using them with confidence. In his first voyage he had no chronometer though his astronomer had been in the ship in which Harrison's was carried to the West Indies in 1763. When he sailed in 1772 he had 4 chronometers but used them little, depending on lunar distances. In the 3d and last voyage on which he sailed 1776 chronometers were carried and relied on.¹

Longitude by chronometer is now dependable, for longitude at many places has been established by parties properly equipped and by submarine telegraph, giving means of checking the running of instruments; thus lunars have been disused; the tables published by our government for them are no longer given I believe. As respects their accuracy it has been estimated good observers can by observing several times in the same place determine longitude in tropical latitude within 20 and in latitude 60° within 10 miles.² Not only by measuring the distance of the moon from other bodies was it attempted to determine longitude but by meridian passage and eclipses. The method by eclipses is accurate but failed from the same reason lunar distances failed, because the *exact* hour of occurrence could not be predicted though their coming could be roughly foretold before the Christian Era; moon's meridian passages failed also because their hour could not be predicted. Eclipses of the moon would not in any event serve because they occur too rarely; and Galileo who had a powerful telescope in 1620 proposed ships should find longitude by occultations of the satellites of Jupiter which occur often and an apparatus for observing

¹ See just below.

² Nature series Pop Lectures by Sir W Thompson v 3, Nav Affairs pp 99-105.

these at sea with telescopes was devised. An attempt to utilize this method was made by Captain Cook and will be returned to below.

CAPTAIN COOK.

James Cook was son of a Yorkshire laborer was born 1728 and went to sea first in a collier when 14 remaining in private ships until 27. At the latter age in 1755 he shipped as able seaman in the British man-of-war *Eagle* and was in the navy until chosen to command the *Endeavor*, being at that time lieutenant. In the *Endeavor* he sailed from the Thames 1768 on a voyage of exploration. In 1762 he married Miss Elizabeth Batts but could have seen very little of his family as the intervals between his voyages were short. His wife died 1835 at the age of 93. While in the regular English navy Cook made many surveys, among others those by which were drawn the charts used by the ships which brought Wolfe's army up the St Lawrence to Quebec. His charts of this river and the Pacific Ocean are still consulted. In his first voyage his longitudes are by lunar observation and he writes of these,³ "The latitude and longitude of all or most of the principal headlands bays etc may be relied on for we seldom failed of getting an observation every day to correct our latitude by and the observations for settling the longitude were no less numerous and made as often as the sun and moon came into play, so that it was impossible for any material error to creep into our reckoning in the intermediate times. In justice to Mr. Green⁴ I must say that he was indefatigable in making and calculating these observations; xx by his instructions several of the petty officers can make and calculate these observations almost as well as himself. It is only by such means that this method of finding the longitude at sea can be put into universal practice, a method we have generally found may be depended on within $\frac{1}{2}$ a degree which is a degree of accuracy more than sufficient for all nautical purposes. Would sea-officers once apply themselves to the making and calculating these observations they would not find them so very difficult as they at first imagine, especially with the assistance of the nautical almanac and astronomical ephemeris, by the help of which the calculation for finding the longitude takes up but little more time than that of an azimuth for finding the variation of the compass; but unless the ephemeris is published for some time to come, more than either one or two years, it can never be

³ P 316 Cook's Journ 1st Voy Capt Wharton R N.

⁴ The astronomer.

of general use in long voyages and in short voyages it is not much wanted. Without it the calculations are laborious and discouraging to beginners and such as are not well versed in this kind of calculations.”⁵

Cook sailed on his first voyage 1768, the British nautical almanach was published first in 1767 and the one for 1770 did not appear until 1769. Unless his ships carried manuscript copies they were obliged to calculate the moon's position. The Endeavor went around the world west returning to England 1771.⁶ These words of Cook are an exposition of the art of position-finding when coming into its present condition. He had an apparatus for determining longitude by occultation of the satellites of Jupiter, and this was also in the ship in which Harrison's chronometer went to the West Indies in 1763. Mr Green astronomer with Captain Cook went this voyage to the West Indies also.⁷ These occultations occur almost daily but a telescope is necessary to see them. Galileo with one mounted on a chair for an observer and slung to minimize motion proposed to find longitude in this way, and long before the day of Cook astronomers had calculated tables giving the moment of future occultations: the method lasted long, for the tables required are in Bowditch's Navigator of 1852.⁸ It is very accurate onshore and calls for little computing; at sea it offers difficulty for the reason that the telescope must be of considerable power and therefore small field and difficult to hold on the planet.

The chronometer carried by the Resolution Cook's ship in his 2d voyage has an interesting story. Leaving England 1772 it was carried around the Cape of Good Hope and along the edge of ice in the South Pacific looking for a reported antarctic continent as far as Cape Horn reaching latitudes as high as 71°—the first ship to cross this wide belt: his ropes Cook says were frozen his sails like plates of metal. From Cape Horn after locating islands near-by in which the chronometer played large part, the Resolution stretched across to the Cape of Good Hope, another long run in a wild sea; she then returned to England. The same chronometer went in the Resolution in Cook's 3d voyage 1776 again going about the world east-bound and reaching this time up as far as 71° N into Behring Strait, where the longitudes determined seem to be those on modern charts. The instrument went in another famous ship; the Bounty

⁵ He alludes in part to calculation of data now found in the almanachs furnished by observatories.

⁶ Of 94 men in her 38 died; most from fever and dysentery at Batavia in Java.

⁷ P XXVII Wharton's Cook's Journ.

⁸ P 252.

sent to the South Sea in 1788 to bring bread-fruit plants for domestication in England: the crew mutinied and set the captain Bligh and 19 men adrift in an open boat 23 feet long; these made a voyage of 5000 miles to safety in latitudes 10° to 15° south.⁹ The instrument was brought to England and is now in the United Service Museum in London.¹

Cook takes rank with the great explorers. The record of his 3 voyages is complete and satisfactory. The story of the 2d voyage when he was in the *Resolution* with the Adventure Captain Tobias Furneaux as consort is of surpassing interest. He left few unexplored parts of the Pacific² and was the first to use with success the aids to navigating which appeared in his day; sextants of almost perfect accuracy, correct tables giving positions of the moon and other celestial bodies calculated years in advance, chronometers too good to believe in,³ improvements in dead-reckoning, and showed how to reach correct positions with these. He wrote, "The commander first lieutenant and astronomer onboard each ship kept each of them keys of the boxes which contained the watches and were always to be present at the winding them up and comparing with one another."

Cook was the first to conquer the deadly scurvy for which remedies had long been carried; he added scrupulous cleanliness dryness and sweetness below-deck, all parts being frequently washed and then dried by stoves; clothing and bedding kept clean and sweet by washing and airing, fresh water being provided by a distilling apparatus or from melting ice.⁴ Respecting fresh water for washing the person and clothes it is only in recent day when ships are steamers with capacity to distil a great deal of water that the crews have fresh water, which apart from being more agreeable washes and dries better than salt. Cook's attention to his crew brought good fruit: when the *Resolution* reached England July 29, 1775 he wrote, "Having been absent from England 3 years and 18 days in

⁹ Mutineers of *Bounty*: the mutineers were found on Pitcairns Island 20 years later.

¹ Kitson's *Cook* p 349.

² See chart giving his track and others in high south latitudes p 1 v 1 *Voy dans l'Hemisph Austr Paris 1778*.

³ Of his chronometer on his 2d voyage Cook shows distrust. He had the same ship, *Resolution*, his 3d voyage and wrote when fitting her Feb 1776, "The board of longitude likewise put into our possession the same watch or timekeeper which I had carried out in my last voyage and had performed its part so well. It was a copy of Mr Harrison's constructed by Mr. Kendall." The *Discovery* the consort of Cook's ship had also a chronometer this voyage; see *Voy Cook 3d Voy 1776-80 London and N Y* p 4.

⁴ John Davis when in the arctic in 1585 wrote, "We came on board again with our boat laden with ice which made very good fresh water," *Voy Hakl* p 4: Davis does not say the crew washed with this.

which time and under all changes of climate I lost but 4 men and only 1 of them by sickness it may not be amiss to enumerate the causes to which I conceive this uncommon state of health was owing xx."

The Resolution and Adventure were the first to cross the South Pacific and South Atlantic Oceans in high latitude the longest run in open sea on earth, being led to this in looking for an antarctic continent. Sailing from England July 13, 1772 the ships reached Table Bay near the Cape of Good Hope October 30. They sailed from Table Bay November 24 and steered south to 50° and the Resolution ran between that and 67° S east to New Zealand. By fogs and gales the ships were separated after which they kept on alone. The Resolution reached Dusky Bay New Zealand in 124 days from the Cape of Good Hope, having covered 149° longitude in latitude 60° . This makes 4320 miles so she made good 35 miles per day; she was in search of land and often entangled in ice, not making a straight-away run.⁵

Not long after Resolution arrived in New Zealand Adventure rejoined and the 2 ran east in high latitude; the Resolution to the west entrance of the Strait of Magellan and thence on around Cape Horn to the Cape of Good Hope: the Adventure made one run from New Zealand to Table Bay passing 350 miles south of Cape Horn. Cook says, "I now gave up all hope of finding any more land in this ocean and came to a resolution to steer for the west entrance of the Strait of Magellan with a view of coasting the out or south side of Tierra del Fuego round Cape Horn to the Strait of Le Maire:" also, "As this was the first run that had been made across this ocean in high southern latitude I have been a little particular in noting every circumstance xx and after all I must observe I have never made a passage anywhere of such length or even much shorter where so few interesting circumstances occurred."⁶ There is a note here by Cook that on meeting Captain Furneaux he learned the Adventure had made the voyage before.

The Resolution sailed from New Zealand to make this passage November 15, 1774 and saw the land at the west end of the Strait of Magellan December 17 following. She was 32 days making $102^{\circ} 02'$ longitude in 55° S: this is 3420 miles; so her daily run is 107 miles; she was looking for land not making a passage. Jan 4, 1775 the Resolution

⁵ North Point in Dusky Bay is $45^{\circ} 43' S 166^{\circ} 27' E$ in modern tables; Cook's log gives it $45^{\circ} 48' S 166^{\circ} 44' E$ when the log says, "Sailing into Dusky Bay."

⁶ Pp 166, 170, v 2 Voy towards S Pole and Round the World Cook London 1777.

steered for Table Bay and anchored there March 17. She was for the most part 50° S; the distance is 3300 miles and the average daily run 45 miles; in the Remarks in the journal there are many entries about land seen or suspected and ice. The Adventure sailed from New Zealand December 23, 1773 and anchored in Table Bay March 17, 1774, just one year before the Resolution. She covered $202^{\circ} 24'$ longitude for the most part in about 60° S in 84 days: the distance is 6000 miles; so the average day's-work is 71 miles.

As stated the Resolution anchored at Spithead July 29, 1775; in a year, July 11, 1776, she sailed with Cook on his 3d and last voyage having the Discovery in company. The ships went to the Pacific by the Cape of Good Hope running east from the Cape in high latitude looking for land and passing into the North Pacific re-discovered the Sandwich Islands in 1778⁷ and proceeded to Behring Strait to see if a passage into the Atlantic existed. The Strait had been discovered by Vitus Behring a Danish seaman in the service of the Russian government in 1728.⁸ When his ships reached 60° Cook concluded from the heavy ice he could not hope to pass into the Atlantic.⁹ He continued on however through the Strait which is about $65^{\circ} 40'$ and 60 miles wide and had Asia and America in sight at the same time. He was as far north as Icy Cape and gives its position $70^{\circ} 29'$, $161^{\circ} 40'$ W;¹ the ship being he says within a very few miles of it. Icy Cape in modern tables is $70^{\circ} 29'$, $161^{\circ} 42'$ W. Cook determined a number of positions hereabout; among others Cape Prince of Wales at the narrow part of the Strait; the westmost point of the Americas. The position may be a little out Cook says because of haziness: he places this $65^{\circ} 46'$ N $168^{\circ} 15'$ W; modern tables $65^{\circ} 41'$, $168^{\circ} 17'$ W. It may be Cook's positions still stand in modern tables; but if this be not so he determined with precision.² After concluding his business in high

⁷ Discovered 1542 by Gaetano a Spanish navigator setting out from New Spain. Cook makes remarks on, "The Useful Situation of the Sandwich Islands."

⁸ Behring explored the north coast of Asia in 1725 and found the Strait named for him 1728, thus proving that Asia and America are separated; he died at Behring Island 1741 after exploring the northwest coast of America to 69° N.

⁹ It was midsummer 1778.

¹ In the ed before me this is printed $79^{\circ} 29'$, $198^{\circ} 20'$. The first is a misprint for latitudes near-by are all 69° to 70° ; the second has been reckoned east from Greenwich all the way around; reckoning the way we do it becomes $161^{\circ} 40'$ W.

² The positions given for Icy Cape and Cape Prince of Wales are from Bowditch ed 1852. Their positions now given by U S Hydrographic Office are (Jan, 1922): "Icy Cape extremity $70^{\circ} 18'$ N $161^{\circ} 51'$ W, according to Coast and Geod Survey Chart 9400 issued June 1917; Cape Prince of Wales western point $65^{\circ} 37'$ N $168^{\circ} 05'$ W, according to Coast and Geod Survey Chart 9380 issued May 1917." These vary little from Cook's positions.

latitude Cook returned with both ships to the Sandwich Islands and here February 14, 1779 was killed by the natives.

COOK'S SHIPS.

The ships were of good size, the *Resolution* rated 462 tons and *Adventure* 336. They were English-built colliers comparatively new straight with the water without high structures at bow or stern flat-bottomed to make them take the ground easily and not coppered.³ They were three-masted, carried fore and main but no mizzen topgallant sail, and spankers like ours with gaff much peaked up, not a lateen-yard: whether the spanker had a boom is not certain. The head booms are long; about half-way out is a long sprit-sail yard and more than once when bad weather is expected this is stated to be brought in and crossed again when weather improves. The extension of the head booms is so much beyond the sprit-sail yard it is hard to believe the ships did not carry triangular jibs forward of the foremast, but there is no appearance of a sail furled on the head booms. The boats were probably carried in-board. In several places it is stated topgallant yards are sent down when bad weather is expected and topgallant masts housed. The topsails reefed were the sails most used at such times; a change from practice of 200 or even 100 years before, when topsails were set in fine weather only and the lower sail with bonnets off was carried in heavy weather.⁴

A SUMMARY STATEMENT AS TO NAVIGATIONAL MEANS AND METHODS IN ABOUT 1600 AND OF THE STEPS LEADING THERETO.

Much has been said about the log and its use and it is proposed here to review this shortly and add matters of later time regarding it. English-speaking seamen mean by the word log both the apparatus by which speed is measured and the book in which events are recorded. The apparatus used a few years ago, the little log-ship weighted to keep it upright when thrown in the water and its measured line to be payed out as the ship goes, is described in Bourne's *Regiment of the Sea*, printed first probably 1570.⁵ The origin of this, too humble a thing for writers to think it worth describing, must lie far back: Vitruvius as we have seen described a log

³ Cook did not want them coppered because of effect on rudder hinges which were iron.

⁴ These notes regarding the ships are from 3 plates in *Third Voyage of Captain Cook* London 1785 3 vs. In the same v is a large chart showing Cook's tracks in his 3 voyages.

⁵ Above p 345; see also *Voy Davis Hakl* p LIII.

like those used now in 25 B C, and the allusion to a log next following is in the reign of Henry VII of England 1485-1509,⁶ being a list of ship-stores which names *running-glasses* lead-lines sounding-leads compasses. The use of sand-glasses to keep ordinary time is very old; in ships these were half-hour and hour glasses and presumably a running-glass was for measuring speed; it would run probably $\frac{1}{4}$ or $\frac{1}{2}$ minute.

There is no doubt that French Spanish Portuguese and probably all ships in the Mediterranean judged speed by observing the water alongside until after the date of Bourne's book. The French called this *estime* and others used similar names; they used the *estime* until about 1700 for Fournier so states in his *Hydrographie* printed 1667⁷ and Navarrete says the old-fashioned log was used in England 1577 but not in Spain before 1692.⁸ The log of simple pattern has been replaced by what are called mechanical logs in which a screw is put overboard with a line to a dial-plate pinned on the stern-rail; the turns of the screw as it is dragged move hands on the dial and shows how far the ship goes in measured time. Such devices or the turns of the ship's wheels or screw are now used to measure speed, wherein we have returned to the pattern described by Vitruvius who says his is very useful and was, "From the ancients."

The log-book or record of the day's-work was kept in one way or another long before the entries now found in it were fixed on. The log of Columbus if what we have was his only record was not very good; we have little from Dias or Gama; and in Magellan's log there is great improvement over Columbus'. The record of Hanno's voyage 450 B C enables us to plot the track and that of Nearchus 325 B C does also, the voyages of the Northmen to America and Othere around the north of Europe 800 to 900 A D can also be plotted. From these times for centuries, during the Dark Ages when few could write, we have a blank; the first light comes about 1150 and in 1527 the King of Spain orders, "All masters and pilots who may come from Espagnola or other parts of India to write down the route they follow both going and coming xx so that quickly the true course of this navigation may be known."⁹

This order is important in history. Another important thing is the *Traverse Book Made by John Davis in his 3d voyage in search of a north-*

⁶ Accts and Inventories Henry VII Eng Navy Rec Soc.

⁷ Above p 549.

⁸ Hist Nautica p 325; see also n 7 p 346 above.

⁹ Navar v 1 p cxxx.

west passage. In the last for each day from May 19, 1587 to Sept 15 is entered course distance run latitude wind and "Discourse:" Remarks the last would be called today. In some cases Davis' log gives several courses for a day each with a distance run whereby position could be pricked on the chart several times a day.¹ No doubt many ships kept as complete a record but Davis' fame has caused his to be preserved. Next we have a notable order of the British East India Company in a commission issued 1610 to Sir Henry Middleton and others to voyage to the East Indies; it directs, "A journal to be kept of each day's navigation and of all circumstances which may occur. Such journals to be kept by the lieutenant merchant purser pilots and master's-mates who are from time to time to compare their notes."² A calendar of logs preserved in the East India office is in the book here cited of which no 17 is Journals of 2 Voyages xx in 1616; both give daily courses wind and latitudes. There are in all in this calendar 115 log-books of the 17th century; the first with printed form and headings to columns being that of the ship Samuel and Anna Captain Reddell 1702.³ Captain Reddell brought home a log very like those now kept but those of Davis' day 150 years earlier were nearly as complete.

CONFERENCES IN SHIPS.

It seems abnormal that many should be called to conferences in ships where authority is absolute. Magellan and Drake who put to death those who opposed them held conferences, but is related Lord Collingwood, very successful with his men and far from violent, told his crews during the Nore mutinies in 1797 he would head up in a cask any man convicted of misconduct and throw him into the sea, and no doubt would have done it and no questions asked. Just when these conferences were disused is hard to say but they must have been rare in the day of Drake. No-one would dream of them now. Two classes were ordered by the British East India Company in their first ship to Japan, the Clove Captain John Saris sailing 1613; (1) "For special occasions of trade and merchandizing" and (2) "For seafaring causes." Also they direct, "Continual and true journals are to be kept not only by the captains but by the merchants pursers masters and master's-mates and these to be compared once or twice a week so as a perfect discourse may be set down to be presented to

¹ Voy Davis Hakl pp 49-58.

² Voy Lancaster Hakl p 137.

³ Pp 263, 277, work cited note next preceding: see p 338 above.

the Governor and Company xx." ⁴ The log both the apparatus for measuring speed and record set down were much as now before 1550 and quite as now by 1650; the beginnings of the 2 lie in a date preceding that of maps, in pre-historic time.

VOYAGES OF CAPTAINS FOX AND JAMES.

Fox and James left record of attempt to make the north-west passage in 1631-2 of which the interesting parts are:⁵

(1) An observation by Fox for longitude; it is much out.

(2) It is stated Hudson in 1610, "Set the N end of the needle and the N end of the fly all one:" the magnet is not usually moved on the card or fly now, but Hudson was where variation is great.

(3) Fox had and used an "Astrolob."

(4) The "Logge-board" mentioned: until almost our day ships wrote their log first on a board; the deck-log it was called.

(5) James', "Clock and watch were so frozen they would not go;" he, "Practiced some observations by the rising and setting of the sun by very true running-glasses. xx My observations by these glasses I compared with the stars coming to the meridian. By this means we found the sun to rise 20 minutes before it should and to remain above the horizon 20 minutes or thereabouts longer than it should do, and all this by reason of the refraction."

(6) Observations for longitude by James: a foot-note says one is exactly right.

(7) By James, "The names of the several instruments I provided and bought for this voyage:" they are all of, "Old seasoned pear-tree wood;" a quadrant divided to minutes, "Of four feet at least semi-diameter;" "A staff of 7 feet long whose transome was 4 feet;" "3 Jacobs staves;" "2 of Master Davis' back-staves;" "4 special needles of 6 inches diameter and touched curiously with the best lode-stone in England;" "A lode-stone to refresh any of these if occasion were whose poles were marked for fear of mistaking;" "A watch-clock of 6 inches diameter and another lesser watch;" "A chest full of the best and choicest mathematical books that could be got for money in England;" a "Log-line," evidently marked; etc.

(8) An appendix on longitude by compass variation by Gellibrand

⁴ Voy Saris Hakl p X.

⁵ Voy Hakl pp 97, 115, 250, 371, 535, 558, 604-6, 612.

born 1597: it is an impossibility he says. Then he goes on about an eclipse he observed for longitude using "A quadrant of 6 foot radius actually cut to each minute of the quadrant." This he must have used to take altitude for time at the instants of immersion and emersion; he may have had a clock but it could not have been reliable: the account gives no means of determining how accurate his longitude was.⁶

CHARTS.

Charts were long made by seamen. Only when government established a hydrographic office in 1795 was their production systematized in England:⁷ this office had no counterpart in this country till 1840 in the day of Lieutenant Maury.⁸ The Royal Title of Principal Pilot was bestowed on Amerigo Vespucci by the King of Spain Aug 6, 1508 when a General Chart was ordered to be prepared and kept corrected, "By which all pilots shall be ruled and governed:" this constitutes the first recorded step made by governments to provide correct charts.⁹ Dias Columbus Magellan and others till later day made their charts from their own knowledge with their own hands. Until after 1600 this was universal; Quiros the pilot who sailed from Callao in 1595 with Mendana when telling of preparations for the voyage writes,¹ "The adelantado ordered the chief pilot to make 5 charts for the navigation one for himself and 4 for each of the pilots;" Sarmiento de Gamboa when about to return from Spain to Peru by the Strait of Magellan in 1583 writes to the King,² "Pedro Sarmiento made the *padrone* for the North and South Seas. As regards the *rhumb*-lines they had been badly ruled on the parchment xx.

⁶ Passage 5 above must mean they knew by astronomical calculations the time from true sunrise to true sunset in the latitude-in for the actual day of the year and compared with this the time elapsed between apparent sunrise and apparent sunset measured by "very true running-glass;" a sand-glass corrected. The steps by which sand-glasses could be made true are not obvious but the incident shows something of equipment carried. I do not think it is indicated in other place that sand-glasses, used on land and sea for ages for measuring time, were corrected: Æneas tells in 300 B C you must take wax from or add it to the inside of a clepsydra to make it right but does not say how to know when it is right.

⁷ Life Capt Martin Eng Navy Rec Pub p xxvii.

⁸ It is not generally remembered Lieutenant Wilkes commanded an expedition toward the south pole and published in 1856 a work called Theory of the Winds giving wind currents and sailing-routes.

⁹ Navar v 3 pp 299-302: it is called *Real Titulo de Piloto mayor con extensas facultades a Amerigo Vespuccio*.

¹ Above pp 612 and foll'g.

² Voy Hakl p 218: above p 628.

Sarmiento constructed 23 charts and a padrone which was sent to Your Majesty. By these arrangements the charts were prepared for this voyage." It will be recalled Drake was often shut up in his cabin to paint charts.³ Charts were on parchment, adding materially to cost and rarity, and pilots jealously guarded their knowledge; when Drake planned to go to the South Sea he helped himself at Lisbon and elsewhere to Portuguese and Spanish charts and pilots.⁴ For a long time Portuguese and Spanish ships were almost alone in laying down lands newly discovered and only vague reports reached northern Europe.

The mention by Sarmiento of rhumb-lines has already occupied attention as means of discovering how charts were made and used.⁵ Rhumb-lines appear on charts made by Dampier about 1700; some show latitude but no longitude lines and radiating lines or rhumbs with centers in the sea.⁶ The Portuguese historian Barros says Da Gama when he arrived in Eastern seas in 1498 found charts, "Arranged after the manner of the Moors which is with many meridians and parallels without other courses; ⁷ as the squares made by the parallels and meridians are very small they have only the 2 courses ⁸ North-South and East-West, without that multiplication of courses ⁹ common on our charts which serves as the *root of other things*." ¹

The words particularly the last phrase show Arab charts were different from those of the West: the former had lines at right angles, only 2 courses North-South and East-West like our charts, the latter had lines drawn from several centers. In Gama's day charts in the West had lines of both kinds and those Dampier carried about 1700, 200 years after Gama's day, had both kinds. At present only lines at right angles are on charts; we have adopted the ways of Arabian pilots and cosmographers of 500 years ago who had inherited their way probably from the Greeks through Ptolemy the Geographer. The way of Ptolemy had been dropped in his own part of the world, the West. Though it seems the radiating lines were used in the West in making and using charts they may have been only for

³ Above pp 623-4.

⁴ Above p 624.

⁵ Above p 628.

⁶ Dampier *Voy Masfield* v 2 p 106 map.

⁷ The Portuguese is *rumo dos ventos* literally courses of the winds; our word *course* means the same.

⁸ In the original *rumos*.

⁹ The phrase is *ventos d'agulha*; winds of the compass-needle.

¹ *Raiz das outras*.

the purpose for which the so-called dumb-compass on modern charts is used; for laying-off courses.² The words of Barros and Sarmiento indicate the lines were to plot position and for the subsequent use of charts: dumb-compasses as well as the radiating lines are on the Catalan map 1375 and a little later Pigafetta who was with Magellan shows how to use them for laying-off courses.³ We now use the dumb-compass for courses and transfer this on the chart by a parallel-ruler or a triangle and ruler worked together; but the former are said not to have been invented until 1574.⁴ This is shortly after charts on Mercator projection appeared about 1569 and on these parallel-rulers are peculiarly appropriate. Mercator charts were general about 100 after this and remained universal in ships more than 200 years.⁵ Captain Saris when in Japan in 1612 in the Clove used a map published in his *Voyage* and says of it, "We found Van Linschoten's book very true for thereby we directed ourselves from the setting forth xx."⁶ The published map is on small scale; the one in the Clove must have been larger.

CAPTAIN DAMPIER.

William Dampier was an English seaman of about 1700 and the maps he probably made and certainly used as well as other records made by him have been preserved. Two of the maps he marked General and Coasting Trade Winds in the Great South Ocean; one shows one hemisphere and the other the other and include both the steady trade and periodic or seasonal winds. Beyond 30° N and 30° S is written across the map Variable Winds. There are also statements about ocean currents, the areas in which they prevail, their changes etc. These are probably the first Wind and Current Charts ever made.⁷ It is not unusual to class Dampier as a buccaneer who circum-navigated the world⁸ but though no doubt he sought gain by his

² Barros Asia v 1 p 319 ed 1778, dec 1, 4, 6.

³ Prem Voy Amoretti p 283: see Jomard Mon Geog intro p 56 as to early charts.

⁴ Enc Brit 11th ed word Navigation.

⁵ Voy Davis Hakl p 350; Hist Mathematiques Montucla v 1 p 650. Wright an Englishman is said to have been the first to disclose the principle of Mercator projection; Montucla v 4 p 531. Mercator's map of 1569 will be found in Jomard.

⁶ Voy Hakl pp 192 for map and 188 for quotation.

⁷ Dampier Voy 1683-88, Masfield 2 vs v 2 pp 228, 242 for the maps; pp 243-304 for Discourse of Winds; pp 305-21, 559-562 as to tides and currents. It should be remembered the maps have been reduced for publication. See p 567 above for what Dampier wrote of rounding the Cape of Good Hope.

⁸ His voy was 1679-91: accounts of the buccaneers and not a little of Dampier will be found in v 4 Burney's Chron Hist Disc of S Sea; see also Hist Buccaneers of America 1704; the last is illustrated.

operations he was attentive to his calling and took the trouble to write. He was before the day of chronometers but his longitudes by dead-reckoning are better than those of his predecessors: as to them he writes, "Our reckonings are liable to uncertainties from steerage logging currents half-minute glasses and sometimes want of care xx. Most of my men that kept journals imputed the error to the half-minute glasses and indeed we had not a good glass in the ship beside the half-watch or two-hour glasses. As for our half-minute glasses we tried them all at several times:" then follow remarks about marking log-lines correctly and starting and stopping them.⁹

Dampier's dead-reckoning in a run from Cape Corrientes in Mexico to the Island of Guam has been preserved. The latitude-in varied from 20° to 12° N the course was always nearly west the day's-work rarely less than 100 and usually from 140 to 196 miles, the ship being in the N E trade-wind. He set down the northings and southings and westings there being no eastings; courses are written west so-many *degrees* north or south as advanced navigators would write today, not in points of the compass: his reductions of courses and distances to changes of latitude and longitude might have been taken from a modern Bowditch. Whether he used for reduction a table as is now the practice or triangles, martolojo or other graphic process, there is no means of knowing; but most likely the latter. When he adds the westings the sum is 7323, "Making degrees of longitude in all 125d 11m," he says; but modern tables give the longitude between Cape Corrientes and Guam $109^{\circ} 45'$. His latitude of Guam is $13^{\circ} 21'$ and $20^{\circ} 11'$ for Corrientes; they are correctly $13^{\circ} 17'$ and $20^{\circ} 26'$. The run is given in 2 parts, the first being 2283 miles which Dampier figures as $39^{\circ} 05'$ in longitude, which is very nearly right; the error is in his 2d part, which he made about 5000 miles. He makes statement about longitude in the East, "According to the different longitudes of England and Mindanao," he writes,¹ "This isle is west from the Lizard by common computation about 210° ." Mindanao extends from $233^{\circ} 47'$ to $237^{\circ} 54'$ W of Greenwich and the Lizard is $5^{\circ} 12'$ W; so Mindanao is $228^{\circ} 35'$ to $232^{\circ} 42'$ W from the Lizard: the error is little over 1000 miles; about $\frac{1}{15}$ since it is in measurement of a line 15000 miles long. When it is con-

⁹ P 410 v 2. There is nothing to show how the half-minute glasses were regulated.

¹ P 378 v 1: the run to Guam just analyzed is pp 297-8 same v: by *common computation* he means dead-reckoning. See p 597 above for longitudes about 100 years earlier.

sidered it is measured by courses and distances during 80 to 100 days, thousands in number reported by many ships for 200 years some going west and some east, and that changes of longitude because they fall in latitude from 50° N to 50° S are not easy to keep track of, it will be admitted ships recorded with care.

Dampier noticed variation of the compass depends not wholly on change of longitude and following this up it came to be noticed the compass changes as the ship's course changes; as iron in the ship moves about the compass. This is called compass-deviation and is corrected by Flinders bars the process being the invention of Captain Flinders in 1805.² With Dampier's descriptions of vessels he saw in the Far East we will leave him: he describes the proa as follows, "The mast stands exactly in the middle with a long yard xx. One end of it reacheth down to the end or head of the boat where it is placed in a notch. The other end is over the stern. To this yard the sail is fastened. At the foot of the sail there is another small yard to keep the sail out square and to roll up the sail when it blows hard. xx The out-rigger is to keep the great boat from oversetting xx. The vessel has a head at either end xx; they need not tack nor go about as our vessels do xx. When they ply to windward and are minded to go about he that steers bears away a little from the wind by which means the stern comes to the wind which becomes the bow only by shifting the end of the yard. xx I do believe these boats sail the best of any in the world. I did try the swiftness of one of them sailing by our log: we had 12 knots on our reel and she run it all out before the half-minute glass was half out; xx I do believe she would run 24 mile an hour." He describes water-tight bulkheads in eastern vessels as follows,³ "On her deck she had little thatched houses like hovels raised about 3 foot high for her seamen to creep into. She had a pretty large cabin wherein there was an altar and a lamp burning. I did but just look in and saw not the idol. The hold was divided in many small partitions all of them so tight that if a leak should spring up in any one of them it could go no further and so could do little damage but only to the goods in the bottom of that room where the leak springs up. Each of these rooms belongs to one or two merchants or more and every man freights his goods in his own room

² See Wharton's *Cook's Voyages* p xii as to Flinders bars; and Dampier's *Voy* v 2 p 411 as to his misgivings about compass variation following longitude.

³ Pp 310, 408 as to bulkheads and proas; above p 212 for earlier mention of bulkheads.

and probably lodges there if he be onboard." Immediately following is a description of the masts and sails of junks which he says are in certain respects better than those of English ships.

CONCLUSION.

Captain Cook had toward the end all things now in sailing-ships; by 1780 it looked as though the last word as to round-ships had been said. But they had still before them The Clipper-Ship Era reaching culmination 1840-50 during which sailing-ships built light and with fine underwater bodies and spars that would have made Dias or Magellan open their eyes and shake their heads made a last and for a time successful struggle. Steamers were already old in 1850. Leaving aside the first successes in obtaining motion by the expansive force of steam we come to a vessel driven in Barcelona harbor in the year 1543 at a speed of 2 leagues in 3 hours; ⁴ being in charge of Don Blasco de Garay a captain in the Spanish Navy. But the application of steam-power progressed slowly. In 1800 there were steamers on inland waters, in 1819 the American ship Savannah crossed the Atlantic from Savannah to Liverpool in 31 days partly steaming and partly sailing, and 10 years later the English steamer Curacoa made several voyages between Holland and the West Indies. Two English ships Sirius and Great Western the latter specially built for the trade sailed from England for New York in 1838; the former made the passage in 17 days and the latter in 15 and from this time there has been service of steamships on this route, the Cunard Company having been formed the same year. A few years later the Collins line an American corporation put steamers on these having been preceded by vessels employing both sail and steam; but the line was short-lived for in 1858 it was withdrawn. Since these days lines of steam-ships have been put in operation in all seas until now it is only in very long passages and bulky freight the sailing-ship can compete with the freight-steamer; the tramp. Iron and steel as the material for hulls came in as power of engines increased and at the present time hulls of all steamers and many sailing-vessels are of these materials.

By 1820-30 many deemed the day of the sailing-ship gone but the vessels built at about this time; Dreadnaught, Flying Cloud, Fiery Cross, Sovereign of the Seas, and a great fleet of others, so strong and fast beautiful and with names so luring, checked the movement.

⁴ The Ship Steinitz p 402: Hist Merch Shipping Lindsay v 4 pp 11-14.

They cut down passages everywhere, making runs from the Atlantic to California Australia China across the Atlantic, wherever there was open sea, at speeds unheard of. The Atlantic was crossed from New York to Liverpool in 13 days, an average of 235 miles per day; the Flying Cloud twice made the run New York to San Francisco, nearly 17000 miles, in 89 days, an average of 200 miles per day, including some hundreds of miles beat dead to windward off Cape Horn. The last passage, reaching latitude 60° S, often made in midwinter when there are only 5 hours daylight and where there is sweep of thousands of miles for the westerly gales to raise great seas, was a trial to the staunch bluff ships Cook had, and many thought the light-built clipper with her towering masts would be torn in pieces. But they were well commanded and manned and came through half under-water is true and with ropes and rails frozen stiff but often without carrying away a rope-yarn as the sea phrase goes. Steamers could not equal this and were out-classed; but their day was coming for no sailing-ship built or to be built can win 3 miles an hour to windward in heavy sea and the long sharp high powerfully-engined steamer of our day can do several times this. The latter too has even greater advantage in regions of calms and variable winds; if nothing else could stop sailing-ships the calms near the Suez and Panama canals would do it.⁵

The ships of this country had short and brilliant life. Our contribution to the art of the sea in 80 years for our shipping did not last longer ⁶ has been considerable; Nathaniel Bowditch, Maury, and Captain Sumner added great parts to the store of knowledge.

In the introduction of a work printed in Boston in 1819 is this, "No cause has tended more to advance the prosperity and glory of the United States than the enterprising genius of our merchants and navigators. They have extended their voyages to the most distant regions of the globe. xx Little more than a third of a century has elapsed since the close of the War for Independence and the commercial marine of the Republic is exceeded by that of only one Kingdom."⁷ This author has more in the

⁵ See Clipper Ship Era Clark; Naval Science Reed; both alluded to p 318 n 9 above.

⁶ From say 1780-1860. At present it shows no sign of reviving but its future is a question too far-reaching to discuss here.

⁷ Mem Com and Nav Black Sea 3 vs Boston 1819 Dearborn p xv: on the title page is written, "From the days of Tyre to our own the relative power of states and their internal prosperity has depended on the solidity of their commercial relations:" a nation without ships has no external commercial relations.

same vein adding that his attention was turned to American commerce in the Mediterranean by Commodore Bainbridge about 1810. The first American flag that passed the Cape of Good Hope and went to China was carried by the ship *Grand Turk*, Jonathan Ingersoll commander; the year was 1784.^a The first American flag that passed up the Dardanelles was carried by the brig *Telemachus* in 1816. She belonged to Messrs Crowninshields of Salem.⁸ American ships won their way in early times when alone they were many because well built and handled. As to this another author of Dearborn's day, this time an Englishman, gives testimony; writing of the Far East about 1820 he says American ships make 3 voyages while others make 2 ask lower freights and carry cargoes in the best condition.⁹

^a P 173 *Ships and Sailors of Old Salem*, Paine. Captain Ingersoll was of an interesting family in old Salem, kins-folk also of the writer: his sister Mary Ingersoll was married to Captain Bowditch, master-mariner, and was mother of the great Nathaniel Bowditch, and Captain Jonathan's daughter, another Mary Ingersoll, was Bowditch's wife. It may be added as not always known that Nathaniel Bowditch was master-mariner as well as mathematician.

⁸ The present writer was in 1906 domiciled 10 days on the bank of the Dardanelles, having passed up the Strait before in the U S Ship *Guerriere* in 1871 or 2. He was told by the American consul that during the interval of 25 years only once had a ship carrying the American flag passed. She was one of the Pacific Mail line chartered by the Russian government to bring home men wounded in the Russo-Japanese war: rarely at this place is there no passing ship in sight and in a few hours the flags of many countries pass.

⁹ *Hist Indian Archipel* Crawford 1820 v 3 pp 289, 338.

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